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Bulletin of the

Taylor Society

A Society to Promote the Science of Management

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PERIODICAL DIVISION
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PROGRAM FOR THE ANNUAL MEETING

FRIDAY AND SATURDAY, DECEMBER 7 AND 8, 1917

FRIDAY, DECEMBER 7

Cosmos Club, H St. and Madison Place
(Entrance on Madison Place)

8.00 P. M. **"Organization Work in the Supply Division of the Ordnance Department."**
By Captain H. K. Hathaway

"College Training Courses for Army Supply Work."
By Lieutenant Richard H. Lansburgh

Discussions of different phases of war services by various members.

SATURDAY, DECEMBER 8

Washington Club, 1010 17th St., Corner K St.

10.00 A. M. Meeting of Governing Board.
11.00 A. M. Business Meeting of the Society.
12.30 P. M. **Buffet Luncheon. ($1.00)**
2.00 P. M. Conference on **"The Centralization of Administrative Authority."**
5.00 P. M. Intermission and Informal Reception.
6.30 P. M. **Dinner. ($2.50)**
8.00 P. M. Conference on **"The Centralization of Administrative Authority"** (*continued*).

The Conference will be opened at 2.00 P. M. by:

Henry P. Kendall, Member Storage Committee, War Industries Board, Council of National Defense; Treasurer, Plimpton Press, Norwood, Mass.; President, Lewis Mfg. Co.; Treasurer, Slatersville Finishing Co.

Morris L. Cooke, Chairman Storage Committee, War Industries Board, Council of National Defense; Member Depot Board, appointed by the Secretary of War; Consulting Engineer.

Among those expecting to take part are:

Major W. P. Barba, Gun Division, Ordnance Dept., Washington, D. C.

Robert P. Bass, Member Sub-committee on Mediation and Conciliation, Council of National Defense.

Walter S. Gifford, Director Council of National Defense.

J. E. Otterson, Chairman Sub-committee on Small Arms and Munitions, Council of National Defense; Vice-President and General Manager, Winchester Repeating Arms Co.

Judge Edwin B. Parker, Member Priority Board, Council of National Defense.

A. W. Shaw, Chairman Commercial Economy Board, Council of National Defense.

Major John R. Simpson, Equipment Division, Ordnance Department, U. S. R.

Henry B. Thayer President Western Electric Co.

Morton C. Tuttle, Sub-committee on Emergency Construction and Contracts, Council of National Defense; Vice-President Aberthaw Construction Co.

Lieut. Col. A. E. Williams, Head of Warehouse Division, Quartermaster Corps, U. S. A.

Major C. I. DeWitt, Supply Division, Ordnance Dept., U. S. R.

NOTE

The Friday evening session and the Conference Saturday afternoon and evening will be open to guests including ladies. Members are cordially requested to invite any friends who would be interested, and to see that notification of all who expect to attend is in the hands of DR. H. S. PERSON, 5216 NEW INTERIOR BLDG., WASHINGTON, D. C., not later than Thursday, December 6.

Hotel accommodations are in unusual demand in Washington at this time, and should be secured individually in advance.

ADDRESS CHANGES

W. J. Adam, 49 Condict Ave., Jersey City, N. J.

Howard G. Benedict, Works Manager, The Glenn L. Martin Co., 419 Guardian Building, Cleveland, Ohio.

Joseph A. Carlin, Care of Joseph & Feiss Co., 2149 W. 53rd St., Cleveland, Ohio.

William R. DeField, Room 526, State, War and Navy Building, Washington, D. C.

Francis Goodell, 137 Newbury St., Boston, Mass.

Harry Moul, Care of C. O. Whitticar, 2003 Columbia Ave., Philadelphia, Pa.

Richard Stanforth, Care of Nashua Gummed and Coated Paper Co., Nashua, N. H.

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WHO IS BOSS IN YOUR SHOP?

INDIVIDUAL VS. GROUP LEADERSHIP, AND THEIR RELATION TO CONSENT AND THE IDEALS OF DEMOCRACY

BY

MORRIS LLEWELLYN COOKE[1]

The European war has developed into a high-powered advertisement for community organization, for the scientific in management and even for capacity in the individual. Notwithstanding much that might be cited to the contrary our great national desire is to be efficient in both government and industry. Individually and as a people we are almost relentlessly seeking the bases of such Efficiency; and we use the word capitalized as a synonym for the maximum of considered well-being. This can be affirmed notwithstanding what appears to be the most conspicuous fact in our current industrial development, i.e. that more and more our people refuse to be efficient beyond their own desires. As the late Robert G. Valentine expressed it—perhaps a bit more emphatically than is warranted by developments to date—"the days of compulsion—the days of service without consent are over. . . . In all those areas of life wherein man deals with man great breaches have been made in the ranks of compulsion."[2] But it would be a great mistake to assume either that this greater liberty of action demanded by the individual necessarily makes for inefficiency or that it acts as a challenge to individual as opposed to group leadership.

Apparently the New World has little to gain from any blind copying of foreign models in this matter of industrial organization and control. German efficiency both in government and industry depends on a philosophy absolutely inconsistent not only with American traditions but with American ideals. In view of the virtual abandonment "for the period of the war" of the fabric of industrial practices and mechanisms built up in Great Britain during two generations largely by the labor unions we are warranted in viewing what *was* the British industrial system with something more than suspicion. Are we not warranted in the belief that there is in the making in America a scheme of direction and control both for government and for industry vastly more efficient and at the same time more democratic than has heretofore been deemed possible?

American life has a decided advantage over that on the Continent or in Great Britain in the more numerous points of contact between groups—if indeed there is not with us a more genuine understanding between classes. Then, notwithstanding much that at times seems to argue against it, is there not among our people a deeper response of the individual to the Authority within himself than is to be found among other peoples? With these two points in our favor and when as a nation we have grasped more completely the significance of that union within industry of science and co-operation which we call Scientific Management may there not be brought about an American Efficiency—at once an expression of the individualism of our forefathers and the vehicle for our more recent collective aspirations? The sanctions of this system will not be militaristic as are those encountered even on the industrial side of German life. It will avoid the pit falls of that type of group action which is so largely responsible for "muddling" in the United Kingdom. And we have the right to expect that pervading its every activity there will be something of the spirit — the *élan* of the France of our dreams and of present day realities.

We Americans cannot put our trust in the much heralded German efficiency for it gives us a kind of science but no genuine co-operation. Science without co-operation is a relatively lifeless thing. America's high calling is to prove for our common humanity that there is a method of production growing out of individualistic leadership coupled with an essentially democratic control which is not only more conducive to race-happiness, but which in its very nature is scientific and is designed to outstrip any system which is the outgrowth of a military or an autocratic regime such as is found in Germany. Military efficiency it must be remembered consists largely in the ability to mass the greatest possible strength at a given place at a given moment. Industry on the other hand struggles rather for steady performance. Peaks or depressions in either demand or output in industry are to be regretted. The "supreme moments" of the battlefield are taboo, and even spectacular campaigns rarely result in permanent improvement.

We can admit that the movement for industrial democracy in this country in its more obvious aspects has been largely away from science and co-operation rather than toward them. But there are reasons for believing that the organized labor movement in the United States must in the near future dig itself in along a front somewhat different from the one it has occupied in England, and by reflection in this country, for a generation or two past. Some at least of the faces of this new formation seem reasonably clear.

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[1] Consulting Engineer, Philadelphia.

[2] From "The Progressive Relation between Efficiency and Consent." Taylor Society BULLETIN Vol. II No. 1, January, 1916.

Two men having formed a partnership may adopt any one of three plans for the conduct of the enterprise. One of the partners may be put in supreme command expressed or understood, or all matters of moment can be decided by joint action, or there may be an assignment of function as between the two partners so that one is supreme in selling and finance, while the other has the final decision as to manufacturing. This is a statement in very simple terms of a problem common to all management. Upon the relation thus established between the individual and the group depends the conduct of a city or a nation, of a single manufacturing establishment or of an industry.

A partnership of two men is admittedly a simple form of human co-operation, but immediately the question of individual versus group direction and control presents itself. To enlarge this group from two to the hundred millions of population in the United States does not alter the underlying philosophy or interfere with the scientific determination of the proper field in which group and individual action should each operate.

Government began with the unhampered will of the strongest single individual and under democracy's warming influence has broadened out until larger and larger groups eventually control political action. In this transition from a régime in which the administrative program of an individual was enforced by the self same individual, to the present time where in matters of government—if not of industry— all administration is supposed to find its warrant in the consent of the governed, we have not always made the sharp distinction which appears necessary between the administrative code itself and the authority which vitalizes it into action. The democratic ideal would appear to be administration by individuals with collective pressure when necessary rather than too much insistence on the part of individuals.

Recently there has been noticeable in the political thinking of the United States a demand for at least a partial return to administrative individualism as evidenced by movements favoring the short ballot, the city manager, longer terms for administrative officials, centralized responsibility, smaller legislative bodies, and the substitution of judicial decisions for those of juries in certain classes of litigation. In our political democracy we are beginning to admit that efficiency comes through giving authority to individuals and requiring performance from them. The initiative, referendum, and re-call are simply some of the checks and safeguards which are essential parts of this scheme of management in its application to government.

Scientific Management stands for the same tendencies in industry. It recognizes that one fact may invalidate a hundred opinions. Scientific Management seeks to set off the territory in which because the facts are obtainable, action can be determined by the facts rather than by caprice. A fancy whether it be the fancy of one or of a million is still a fancy. We cannot vote on a fact. Action by opinion ebbs and flows while action based on the facts can be reasonably consistent and permits of logical and continuous growth. The truth does set us free.

In our scheme of industry and of government the distinctions between these two territories — one of law and the other of judgment—will become more apparent. Collectively we shall gradually learn to trust individuals to read the facts. We may in time class many of these individuals as experts and ultimately revere them. Nor need we abandon the scheme because at this point and that we are occasionally betrayed by misjudged abilities and limited vision. On the other hand the Democrat will not be asked to *vote* once a year on town clerks or minor bond issues. Rather each hour in the day in industry and in life he will render his judgments made all the more necessary in a world broadened by the discoveries of science and deepened through our quickened insights and appreciations.

While the tendencies in our political democracy seem to be in the direction of a larger degree of individualism, certainly in that part of the labor movement which has become organized no such drift is as yet to be observed. According to what appears to be the code of the labor unions and of some of their most distinguished advocates the most satisfactory way to settle almost any question is to vote on it. If by its very nature it cannot be voted on it must then be deprecated. Democracy and voting are under this dispensation synonymous terms. It may be easy to prove that the leaders of the American Federation of Labor do not hold to this very consistently as a general philosophy of life but nevertheless it colors most of the relations of organized labor to the public. In fact the growing demand for what has come to be known as "Consent" under the most frequent interpretation seems to involve a maximum of *group action* rather than a maximum of *action by individuals.* "Consent" as nearly as I can discover involves a much broader application of the theories underlying collective bargaining. Our activity and loyalty even in minor matters is to be secured only after a collective measuring of the pros and cons.

The collective bargain has found its field principally in the agreements between individual employers and their employees and has concerned itself largely with hours and wages and only secondarily with the other conditions surrounding employment. "Consent" on the other hand seems to involve much broader relationships of the group which works for wages to government, to industry and to society. The relatively primitive struggle for higher wages and shorter hours gives way in a sense to a struggle for standing. Minor claims such as those for compensation on account of injuries are superseded by a claim to a share in the conduct of the business whether it be a manufacturing establishment, an industry, a city or a nation. I am picturing this widening of the front of the labor propaganda not because I lack sympathy with it but only to question the one phase which puts a premium on group administration and group decisions.

It may seem axiomatic that because in working out our political democracy we have been in the habit of expressing through the vote our collective pleasure on all kinds of matters—questions of judgment as well as questions of fact — that therefore we must necessarily pass through a similar period in working out our industrial democracy. But possibly we in America can, because of our growing respect for science and our dedication to co-operation, work out a system by which those who work with their hands and their heads and those who represent property interests will each have their proper share in the conduct of industry and in its rewards and this without the necessity of resorting to a vote on the length of a mine car, the proper shovel load for a day laborer or the use of instruments of precision such as the stop watch.

The growing demand for "consent" as voicing a natural re-action against a too autocratic control in industry is to be welcomed without any reservation. But if "consent" necessarily implies an unwillingness to follow the individual—except after a vote—and substitutes everywhere group action we will most certainly have stepped from the frying pan into the fire. For it is only through individuality in management that we guarantee to society the maximum of production and bring to each worker the largest possibility of joy in his work and more important still keep free the human spirit for those adventures without which it were better that this old world of ours should grow too cold for human habitation. As Robert B. Wolf has said "the *function of the group* should be the greatest possible amount of freedom for the development of the individual." Industrial democracy has forged the collective bargain to act as one check against the excesses of individualism. But we must be careful lest the check be used, as some of our political checks have been used, so as to destroy all chance of positive and strong and timely action.

One of the principal indications of an impending shift in the front of the labor movement in this country is found in the fact that many of labor's foremost spokesmen admit that in increased production lies one of the most hopeful routes to a higher social and economic status for those who work with their hands. In several recent reports—largely influenced by the American Federation of Labor—where this question of the effect of increased production was distinctly raised, labor's representatives refused to oppose increased production as such. This is a far step from the "ca canae" and "soldiering" recently and openly advocated and practiced. The laboring classes were of course partially forced to such resorts by the attitude of boards of directors in refusing to administrative officers the right to pay to especially proficient workers high wages—or at least to pay wages much above the district scale.

Scientific Management stands first, last and all the time for increased production. But production is interpreted in the broadest fashion as including everything that makes for human happiness. Thus Marshall points out that art and even the concepts of the mathematician may be production in the very highest sense. Scientific Management holds that equal opportunity and liberty itself are aids to production, that poverty is unnecessary and that labor does not even approximate being a commodity.

Anyone who doubts whether this matter of "Consent" is to be pressed should read articles on the subject which have appeared during the last few years in some of our leading periodicals over the signatures of Justice Louis D. Brandeis, Minor Chipman, the late Robert G. Valentine, John P. Frey, secretary of the Iron Moulders Union, Felix Frankfurter, Robert Bruere, and by the late Robert F. Hoxie. One finds of course even among this group of writers considerable variety of opinion as to the means which it will be wise for the laboring classes to use in giving voice to "Consent." But no one of them apparently has much faith in the possibility of a fairly rigorous individualistic administrative policy that is to be protected and even induced under group control.

This whole question has been brought to a focus recently through the passage by Congress of legislation absolutely prohibiting premium payments and the use of the stop watch in several important branches of the government service. At the last session strenuous efforts were made to broaden the field for this legislation so as to include all classes of government work. Of course there are only preliminary skirmishes in a legislative campaign whose real object is to forbid the use of these aids to a genuine science of industry in all establishments having government contracts, and finally to include industrial establishments generally.

At least one large national association of artisans—the electrotypers—have recently established a uniform selling price for the product on which they work. With both the wages to be paid by the employer, and the prices which he may charge for his product fully determined by group action—and virtually by the organized labor group it will be admitted that a radically new industrial situation will have been created. The field for "Consent" will have been materially widened.

Everyone seems convinced that we are on the threshold of some very considerable readjustments in our American industrial world. It is entirely possible that present tendencies may become emphasized. But it seems equally possible that organized labor will in the immediate future discover the futility of some of the remedies which are being pushed today with the utmost enthusiasm—administration by groups rather than by individuals among the number.

Perhaps the most obvious mechanism of group action in industry—as it is in government—is the committee. My views on committee management have been fairly adequately expressed in "Academic and Industrial Efficiency," published by the Carnegie Foundation for the Advancement of Teaching. But there are two additional points that should be made. In almost every instance which has come to my attention in which a committee in a factory was supposed to have full responsibility it had in reality very little. A shop committee has responsibility only when it pleases those who hold the purse strings to let it have its way. A committee may decide 999 things out of 1,000, but the fact that the members of the committee are kept from deciding the last one, and of course the critical one, keeps them from having the same kind of responsibility which the owner of a business has. Authority with such a string to it is not what is really meant by "Consent." Employers should not flatter themselves that workingmen confuse committee control with genuine industrial democracy. It is of the essence of democracy whether political or industrial that it shall be motived from below and not dictated from the top.

Under any reasonably modern or discerning attitude toward industry it must be conceded that in those things we do and in which we ask the worker's co-operation we must have his permission or "Consent." But care must be taken to see that in freely granting this contention we do not appear to be advocating something that is unthinkable. No surgeon for instance would operate on Samuel Gompers for appendicitis without the latter's permission. But once having secured Mr. Gompers' "Consent" no reputable practitioner would permit him to dictate as to instruments or methods. In thus placing himself in the hands of this type of expert surely Mr. Gompers does not feel that he compromises in any way his independence.

All workers from the top to bottom are entitled to essentially the same treatment and consideration. I wish the opportunity to say whether I will or will not. I cannot logically deny this to any one else. Nietsche says, "Whoever has inflicted upon you the law from without has degraded your moral individuality." It is not desirable to have a man do a thing merely because I tell him to do it. Obedience is rather a primitive virtue. I wish my associates to assume that I am sincere in wanting them to do only those things which they elect to do after as full an acquaintance with the facts as the conditions under which the work must be done makes possible. It very rarely occurs that things fail of the doing on account of this attitude. In other words "consent" may be interpreted as something larger than the opportunity to vote on each individual problem. Perhaps someone asks what we are to do with the so-called malcontent and kicker. An inquiry as to why such a one is discontented might develop the answer to the question. But even if it does not, I am not sure that any work shop is not better for an occasional disgruntled employee. They are not so disposed every hour in the day. The task of winning them puts everybody on guard. One or two cats are not undesirable in a work room, although it will be admitted that too many members of the feline family might interfere with the even flow of the work.

Is "Consent" in reality always a collective matter—does it always involve group action or can it on occasion become a matter of the individual entirely? May we with safety allow this individual "Consent" to apply broadly to a field involving not one, but an indefinite number of decisions? Similarly, may it not be possible to make individual "Consent" operate not only for the moment but throughout a period of time during which many decisions will be reached? These do not seem to be concessions antagonistic to a proper self-respect on the part of the individual worker, nor to the solidarity of the working classes nor in fact to the maximum of industrial freedom and democracy. But these conditions are vitally essential if we are to develop genuine American Efficiency. Each day the discoveries and developments of science make the opposite course increasingly unthinkable. It is hard enough today to keep pace with the possibilities of progress with functionalized management, which of course means the leaving of final decisions in each function to one rather than to a group. But in the immediate future it is going to be very much more difficult. You will recall Mr. Taylor's prophecy that within two generations there would be 50,000 books on industry for every one we have today. Hugo Munsterburg says in "Psychology and Industrial Efficiency"—"In a large manufacturing establishment the manager assured me only recently that more than half a million different acts have to be performed in order to complete the goods of that factory." This may have been an exaggeration, but I know of no industry where the operations are not in the hundreds of thousands. To hold that we can permit every move in an industrial plant to be submitted to a vote simply shows a lack of understanding of the Game of Industry.

The cause of popular rule in this country and elsewhere seems to depend upon the correct decision as to this broad question of the group versus the individual. The system demanding one king gives way to a system of many kings—kings of the counter, kings of the lathe and loom—all kings, but only by virtue of superior knowledge. They *know.* But the reign of each is dependent upon the general acceptance of the individual's right to decide on facts and conditions. Our progress and even our security seem to lie in having the vast majority of judgments rendered by the informed individual.

Should we not learn in every relation in life to follow the lead of the particular individual who is charged with any given function, whether he be the President of the United States, the traffic officer, or the clerk in the office? We must not only follow these leads, but use our influence to have others do the same. On the other hand, should we not train ourselves to perform one or more functions so efficiently as to command the respect and loyalty, and reasonably willing service of those upon whose support we are dependent for success in the accomplishment of the work in hand, the earning of our livelihood and whatever success we are to achieve? I personally wish to live in a world where it is possible for me to conduct myself along these lines and in which everybody else shall have the same opportunity. This will never be possible in a world run by shop committees or determining boards, or even by labor unions, especially if the latter are so organized that everything has to be decided by group action. Both as affecting the individual and the nation, the development of real democracy depends upon utilizing the high power of individual action, coupled with all the safeguards that can be erected through appeal, investigation and review, and the freest possible publication of results, with final action based on the judgment of the governed.

I do not wish to have any misunderstanding about my attitude towards the responsibilities and the rights of individual employees. I believe that the *most important function of management* is to develop within the factory an educational system designed to get every employee "going from within so that he will run himself" in order that he may gradually assume a larger and larger share in the general conduct of the business. "We want all along the line," to quote H. B. Drury, "not only men who can do what they are told to do, but men who can do things we would never think of ourselves. We want men who have enough interest, and education, and experience and boldness, to make positive contributions to the intelligence and vigor of the work." This requires something more than lip service and hand service. It means head service and heart service.

To ask committees, however, to pass constantly on matters about which by the very nature of things they can have at best a minimum of information, is like giving unbridled liberty to a boy because you want to make a man of him. It is demoralizing to any man to be given the opportunity to deliberate and to decide on matters where he is without sufficient education and special preparation and an adequate fact basis, for a scientific decision. I believe in advisory committees, but in each function of the administration the final decision must be made by the individual. Nothing must tend to prevent that individual from making decisions whenever in his judgment the time to decide has arrived. Decisions must be open to the fullest possible investigation and review—to be followed by a reversal of the decisions if the facts reinterpreted so dictate.

There is one fact connected with industry which requires special consideration. Very few people, either in the labor ranks or out of them, really wish to assume or are able to assume broad responsibilities. The work of the future will be to teach people to be eager to assume responsibility and to co-operate effectually. And this cannot be brought about unless the worker is inspired with joy in his task. Hereafter the Captain, whether of industry or of government, will necessarily be the man who loves, and loving, understands, and understanding, builds and leads and inspires great numbers of his fellows.

Since the discussion of the eight-hour day for railroad employees became acute we have heard a good deal about the possibilities of relief from such situations through wage boards and industrial commissions. To advocate any such regulating agency in this field at the present time is simply to say, "Let George do it." It is not a solution. Let me quote four typical and random paragraphs from recent orders* of the New South Wales Industrial Commission to give you an idea how industrial regulation by commission works:

a. If the work required of them is not in accordance with the general custom of the trade, and is not covered by the definition in clause 8 of the award the drivers cannot be compelled to do the loading and unloading.

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*The New South Wales Industrial Gazette issued (monthly) by the Dept. of Labor and Industry—Vol. x, No. 4, August, 1916, pages 685, 721, 845, and 872.

b. The rate prescribed for a driver of an engine with a cylinder under 12 inches in diameter is 1 s 4½ d per hour. Nothing extra need be paid to a driver who is required to clean windows, etc., but the rate mentioned must be paid in any event.

* * *

c. An assistant is an employee other than a pastry cook, packer, apprentice carter, or motor-wagon driver as above defined, and who does any or all of the following work, viz.: bring in raw materials; wash, clean and grease pans, tools, tins, and other utensils; clean and wash machines; label tins and boxes; wash and sugar goods; wrap cans and pastry; crack eggs; clean fruit and cut peel; put on and take off peels; attend reel, traveling and draw-plate ovens, provided that a journeyman is in charge; place goods into and take goods from tins, trays, pans, trucks, racks, bins, and cupboards, before, during and after the manufacture; pack goods in bake houses; clean bake houses, yards and premises, feed and take from machines, put on and into and take from tins, trays, and pans any goods in any stage of their manufacture; top and bottom pies.

d. Men working in wet places are to be paid 1 s per. day extra irrespective of the time so engaged. Note: Such wet places are to be determined and declared to be such by the employer and employee by mutual arrangement. In the event of the parties failing to agree it shall be referred to the chairman of the Board for his decision.

It should be a matter of deep concern that except for the labor unions there are almost no routine agencies in American industry through which may be obtained an expression of shop opinion—individual and collective. The typical employer claims that he knows what his men think. But as a matter of fact it is as impossible to get the real attitude of mind of a worker or a group of workers from the employer as it is from the labor leader. The machinery through which complaints can be safely made and shop justice gradually established is yet to be devised. As new problems will always be coming up the settlement of present ones is first of all necessary. The struggle must be to keep at a minimum matters on which debate is desired. The effort must be to anticipate any proper demand of an individual worker or group of workers as to hours, wages or anything else. The plan for this kind of thing is the function of the highest officers of a company. The average foreman is too preoccupied with the day's work to do it.

The labor unions have for years been quoting Carlyle in using the words "Organize, organize, organize." Without going further they are misquoting him. However, when Frederick W. Taylor wrote "Co-operation" into the world's industrial creed and into the mechanism of industry he altered, and to an extent weakened the argument for organization as this has been practiced by labor unions in this country, and more especially in England.

To admit a labor union to a plant not previously unionized or to go through the forms of co-operating with one already there does not necessarily mean cooperation in the sense in which Mr. Taylor used it. Sometimes it is easier to admit a union than to keep it out. Again it may be easier to appear to co-operate than to reveal an actual attitude of opposition. The fundamental test is not whether you have unions or do not have them. In some sections of the country and especially in the larger industrial establishments the complete absence of unions would indicate something peculiar in the management. It is equally true that most manufacturers having unions and taking credit therefor are claiming something to which they have slight title. Ninety-nine manufacturers out of 100 who have unions have them only because they cannot help themselves.

I have heard of one plant in which the employees are treated in enlightened fashion that was forced by pressure of a peculiar kind exerted from without the establishment to go through the forms of unionizing on practically the standard basis because, as the national leaders said, it was such a good place to work that the very fact that it was a non-union shop constituted a constant reflection on the organized labor movement. This means that employers who treat their employees in the matter of wages, hours, safety appliances, etc., even below the average may easily be immune from labor agitation while those who study and sacrifice to produce improved conditions become the more liable to interference on the part of organized labor.

If Scientific Management stands for anything it stands for cutting out the "bunk" in every relationship. It is a mockery to call anything short of this scientific. I can understand acquiescing quite whole heartedly in the establishment of one or more typical unions in my shop. I can even picture sitting down and planning with their leaders for their establishment. But no matter how convinced we may be as to the desirability of organization for the workers of the world, an unquestioning acceptance of all present-day labor union methods and objectives is obviously impossible. This makes all the more necessary, however, a generous sympathy with their ultimate purposes and an appreciation of the difficulties and achievements of their leaders.

An employer should welcome every possible check on his honesty of purpose, breadth of view and genuine efficiency. The solidarity of the employees is one of those checks which every right minded employer should both covet and cultivate. But to advocate in industry a type of labor unionism which prohibits the use of the stop watch and the payment of rewards for high performance is to advocate ultimate industrial slavery—however novel the type. A labor union propaganda which does not provide for constant experimentation and the encouragement of new types of organizations is short sighted and not big and broad enough to hold within itself the germ of a republic both politically and industrially free. Research should be as vitally necessary to the wise solution of the problems of labor as to those in other fields of human endeavor.

The labor movement must inevitably seek a new alignment—along which efficiency will become one of labor's own demands—eventually its cardinal demand. The employer who clings to an antiquated machine or one whose system of management is not of the best will ultimately be as obnoxious to labor as are today those who work long hours and pay low wages. In the Great State production will be made a part of the responsibility of labor. And here is where Co-operation comes in. Because, as Taylor has pointed out, you can drive men into working hard but it is impossible to drive them into working efficiently. The friends of labor are sometimes tempted to fear Scientific Management simply because it is efficient. Formerly the *New Statesman* and sometimes our own *Survey* have viewed it as a chain newly forged about labor's neck. Such an attitude fails to take into account the fact that true Scientific Management is a closely articulated, delicately adjusted mechanism such as is clearly impossible in an atmosphere of dissatisfaction and discord. It cannot be built out of collective bargaining, even though individual and collective consent are inherent in its practice.

Do not let us put the onus of reform on the already over-burdened workers of the world. If men ever learn to work together and live together efficiently and happily it will only be as we develop a new technique for the individual, yes—a new reverence for the individual. But this is only indirectly the problem of the group or the mass or the "mob," if you must call it that. The responsibility for leadership lies first of course at the door of the leader. In the development of a true leadership lies the great hope of democracy—whether it be political or industrial. Only through enlightened leadership can we establish a proper relation of the group or mass to the individual—and the leader is he who points the way and pushes on, and gaining one eminence uses it only as the basis from which to climb higher.

We can be reasonably sure that the leadership of the future will be far removed from the military ideal which has stood civilization in good stead to date. Even in military affairs it begins to look as if we would hear less about the martinet and more of the man with genuine knowledge, imagination and enthusiasm. I rather think that for the highest efficiency we have too little instructing and too many instructions in industry and business. We work on the fiction that an instruction once issued is carried out to the letter. As a matter of fact most instructions especially in the higher and therefore more important reaches of industry are only imperfectly understood. Then again each worker in the last analysis executes only that part of what he understands to be his instructions, which he feels to be essential. Occasionally he does something because he is afraid not to do it. Now if you make a practice of never issuing orders as such it puts it up to you to keep your man convinced. The result is that your associates in practice actually carry out what has become their own purpose as well as yours. You undoubtedly lose here and there—especially in the matter of military precision. But your gains are infinitely greater than your losses. Notice is given to your associates that you do not mind being shown wherein you are mistaken and do not expect anyone to do the foolish or inefficient or dishonest thing simply because it was your order or they thought it was your order to do it. So commands make way for orders, and orders for instructions, and instructions for information for employees. The argument is in no wise weakened even if we admit that this system "has still to establish its mutual disciplines and possess its mind," to borrow a phrase from H. G. Wells. It will become increasingly difficult for concerns operated on anything like a military basis to attract to their employ the best class of employees. Industry and government today can have in them adventure and romance—in fact must include both if they are to be properly conducted. More and more our young men of promise will demand the opportunity to associate themselves with industrial undertakings dominated neither by the anti-efficiency propaganda of the English labor unions nor by the militaristic know-nothingness of certain types of big business.

To analyze the leadership of the future we must recognize in it a twofold quality. We are told that there can be no sound where there is no ear to hear. In some such sense it is true that there can be no leadership if there is none to follow or none to follow gladly. This following is just as important as the leading. To be a leader a man or a woman must first *KNOW*—know what his job is, and then have the experience, the ability, the judgment, the enthusiasm and the vision to execute this allotted task. Just that has been enough to "get many a man" by in the past. But the time has gone when it is enough. It will become increasingly necessary for the leader of the future to be able to visualize these facts and capacities to his several constituencies. As the group widens and the interests of the individual deepen this becomes a more and more difficult task, but one to which the powers of the truly great will be attracted.

For the followers there is a twofold duty, for it is upon them in the last analysis, under any democratic scheme that even the ablest and most versatile leader must depend. First, we of the mass must learn to be able to be discriminating as to our leaders—we must know more and more about the work of government, and more and more about the methods and objects of industry. Otherwise we are ever at the mercy of the charlatan. But beyond this there is a second and most important function of the crowd. We must command the means of making our support effectual. It is not enough to recognize the superintendent of our shop or a President of the Republic as a good and efficient man. We must learn how to make these leaders feel our support and to make our associates know of it. If democracy demands leadership to make it efficient then democracy will be a failure unless we can bring about these conditions without which individuality in management becomes unworkable.

Whether we like it or not the day has gone by when a leader of men can afford to neglect any opportunity of getting himself and his work placed fairly before his public. But he must do more than this. He must in many instances create these opportunities for visualizing to the mass of the people his activities and those of his associates. There is so much that is distorted and untrue said about anyone doing important work that the mere desire to offset and neutralize this mis-information requires much educational work. The times and the conditions of both government and industry and the needs of society demand even more than this. It is not enough for the officer of a company or the superintendent of a shop to be honest, active and able. He must make his associates know this. He must keep his constituency convinced and with an ample factor of safety. If we are to have co-operation we must have genuine, relentless publicity affecting every relation.

The picture of a frock-coated and portly gentleman sitting solitary and silent behind a roll top desk in the front office during those rare intervals between meetings at the bank and at the Board of Trade is no longer our symbol for industrial leadership. We demand more and more frequent points of contact with our leaders. We prefer to be the president's associates rather than his men. The sphinx is increasingly at a disadvantage in comparison with the man who can place his cards on the table. Whether it be for the employer of five or fifty, 5,000 or 50,000, makes little difference—self-revealment, incessant and studied—but above all true to the facts—has become the great moving force. Science is beginning to illumine all the work of men. Everywhere even in the humbler daily tasks she provides an art. Our industrial relations are no longer for the isolated plant only. They are trade-wide, industry-wide, nation-wide, yes, world-wide. In this maze if men would tread with freedom, love must enter. The dream will never come true through collective bargaining alone.

You—our leaders in government and in industry take notice! If you force us to it we will run the ship —whether of industry or of state—by group action. But we are eager to co-operate with you, to supplement you where you are weak, and to back you up where you are strong—if only you are Our Men. We, the workers of the world, believe just as genuinely in science as you do. We both have some way to go in understanding the relation of science to industry and in appreciation of all that co-operation may involve. But we firmly believe that if the Boss will only reveal himself to his men the men will reveal themselves to the Boss.

The industry for which we plan must be made dynamic everywhere and all the time. Industry like life itself becomes static when simply reduced to formulae. Our standards must be only the bases for aggressive action. While realizing that science is making possible a measure of good will heretofore unknown in this field, we must see in the bringing about of industrial order no getting away from the necessity for struggle and the strenuous life. But it must be a strife which will develop rather than hinder the human spirit. Let us seek first an individuality in leadership which shall bring actual responsibility and joy into every grade of work, and then the encouragement of group control to the end that the cause of a genuine industrial democracy shall be advanced and production carried to new levels of enthusiasm and accomplishment.

PRINCIPLES OF STORAGE APPLICABLE TO ARMY SUPPLIES

STORAGE COMMITTEE BULLETIN NO. 7[1]

By Henry Wood Shelton[2]

1st Edition June, 1917. Revised November, 1917.

The aim of this memorandum is to aid in decreasing the cost of handling stores, in increasing the rapidity of their inspection and the accuracy of their control, and in reducing spoilage due to careless methods. Certain broad principles fundamental to good stowing practice in general are given in Part II, and discussed in Part III. Various specific rules for handling are given in Part IV, and might serve as the beginning of a set of instructions for standard practice.

The terms used in stowing have never been generally standardized. The meaning of such words as item, lot, unit, tier, block, stack, etc., are but vaguely comprehended, largely because of ambiguity in their use. The definitions given in Part I are offered as one step toward a generally recognized nomenclature, necessary for accurate instructions.

Designed for general use, the rules and principles here given are applicable to normal rather than special or exceptional conditions. Where special conditions or experiences suggest additions or changes a full statement of the facts and conclusions is desired by the Storage Committee of the War Industries Board.

Part I.—Definitions

1—*Stowing:* The putting away of things, usually stores, in their proper places according to proper method. As the subject of this memorandum, it covers the larger ground of removal and general rules for handling.

2—*Item:* Any one kind of stores to be put in one place. e.g. *Canned corn,* No. 2 size cans, xyz brand. Difference in size, shape, nature, quality, weight, color, make, brand, or style, will generally determine different items.

3—*Lot:* A quantity received and stowed at any one time. e.g. *50 cases,* 24 in case, canned corn, No. 2 size cans, xyz brand.

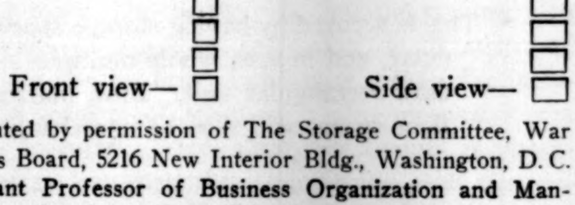
4—*Unit:* A quantity easily handled or normally issued at one time: e.g. Wholesale—*1 case,* 24 in case, canned corn, No. 2 size can, xyz brand. Retail—*1 can,* canned corn, No. 2 size can, xyz brand.

5—*Article:* Any single piece: e.g. *1 can,* canned corn, No. 2 size can, xyz brand.

6—*Pile:* A heap, irregular in shape. Regular piles are defined under column, stack, and block.

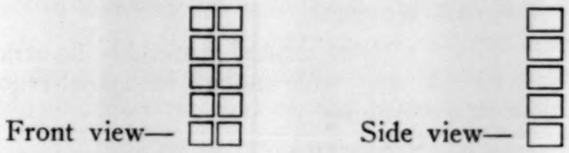
7—*Column:* A vertical, self-supporting, regular pile, one wide, one deep, two or more high.

e.g. Column of 5

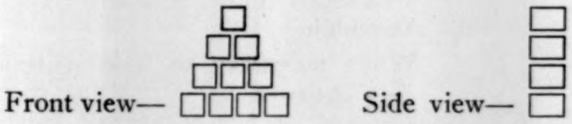


8—*Stack:* A self-supporting regular pile, two or more wide, one deep, two or more high. A stack may be either *cubical* or *pyramidal.*

e.g. *Cubical stack* of 10

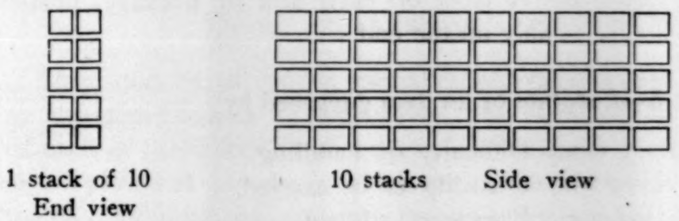


Pyramidal stack of 10

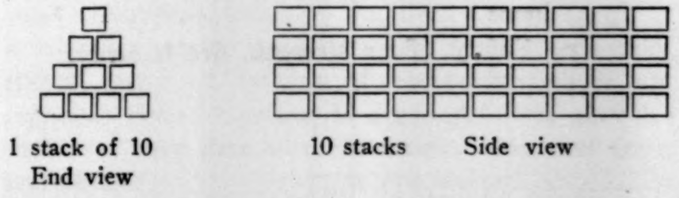


9—*Block:* A self-supporting regular pile, two or more wide, two or more deep, and two or more high. A block may be either *cubical* or *pyramidal.*

e.g. *Cubical block* of 100



Pyramidal block of 100



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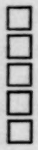
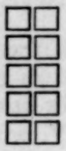
10—*Tier:* Any one separate part of a column, or a horizontal row of a stack. Tiers are numbered in the order of their stowing—from the bottom up.

5 tiers of 1 each in a column.



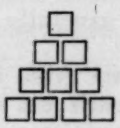
Front view—

5 tiers of 2 each in a cubical stack.



Front view—

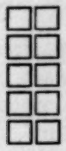
4 tiers of 4, 3, 2, and 1 respectively in a pyramidal stack.



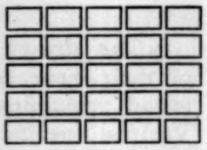
Front view—

11—*Course:* A horizontal layer of a block (cf. the *courses* of a brick wall). Courses are numbered from the bottom up.

e.g. 5 courses of 10 each in a cubical block of 50.

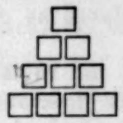


End view—

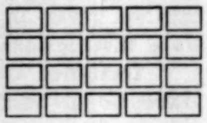


Side view—

4 courses of 20, 15, 10, and 5 respectively in a pyramidal block of 50.



End view—



Side view—

Part II.—Fundamentals.

"A place for everything, and everything *properly* in place."

1—*Definite spaces,* preferably marked, reserved exclusively for

a. Moving.
   Aisles should preferably be straight, and only wide enough for actual requirements.
b. Stowing.
c. Receiving.
   When necessary to hold material awaiting disposition.
d. Assembling.
   When necessary to hold material awaiting delivery.
e. Shipping.
   When necessary to hold material awaiting shipment.

2—*Identification,* clear and complete, of every item.

a. A tag for each lot.
b. A label on each unit or package, preferably on the end.

3—*Location* of an item governed by

a. Difficulty of handling.
b. Quantity to be carried.
c. Frequency of use.
d. Special considerations, as of sensitiveness, perishability or peculiar similarity to other items.
e. Safety (floor strength, fire hazard).

4—*Immediate accessibility* of items, lots, and units, without rehandling.

This means

a. Goods will be stowed in issuable units.
b. Each item (and each lot where practicable) will be kept distinct. Therefore a unit of one item or lot will not be stowed on top of or in front of a unit of a different item or lot.
c. Goods will be placed so that the greatest number of individual units or packages will show. This facilitates counting, as well as accessibility.

5—*Standard methods,* defined in written instructions, of *placing and removing* various classes of items.

a. Uniformity—always piling the same item the same way, and in such a way that each full column, stack or block will contain the same quantity as each other full column, stack or block.
b. Distinct separation of each lot, so that old lot may be used first.

6—*Flexibility* in arrangement.

This is secured by having storage spaces rectangular, and in area whole multiples of a standard rectangular unit. Bins, platforms, and floor spaces will then be interchangeable.

PART III.—DISCUSSION.

1—Definite Spaces.

Aisles must be kept clear.

The real reason for taking pains that stowing of stores shall be orderly and systematic is to be able to get at what is wanted when it is wanted, with the least possible expenditure of time and effort. This involves having what you want on hand in sufficient quantities and knowing where it is. The only way of getting at what is wanted is by means of the aisles and passageways provided for the purpose. It is axiomatic, therefore, that the aisles should be of only such width as is required for the necessary passing and handling of the goods to be stored. It is equally fundamental that they cannot be obstructed by things left standing in them or by the projection of things stored along their margins. The delay caused by unexpectedly encountering a blocked aisle is always wasteful,—likewise, the danger of damage to goods projecting from the proper bounds of either storage spaces or conveyors is obvious.

Aisle widths.

Aisles should be planned according to their use and the size of conveyors or materials to be handled in them. Main aisles for two-way passing of trucks may need to be six or eight feet, or even more in width, according to conditions. Side, connecting aisles, or those straight through the building, for one-way passing, need be only comfortably wider than the trucks to pass through. Blind side aisles, ending in a wall, if for trucking, normally should be wide enough to allow the truck to safely turn around. This is especially true where four wheel or elevating platform trucks are to be used. Thirty inches is a standard width for aisles between bins or shelves where the contents are package goods carried by hand.

Boundary lines.

Showing the boundary lines of aisles and likewise of storage, receiving, assembling, and shipping places is important in order that there may be no vagueness about the limits of the spaces required for each. The more permanent and conspicuous these boundary lines are made, the better. In buildings, lines two inches wide, of black or red paint, or of strips of zinc tacked to the floor, have been used effectively. The right amount of space in a well planned stores layout is essential. More than this amount is wasteful, whereas less than this amount for each particular purpose leads inevitably to congestion, and congestion must be avoided.

2—Identification.

Symbols.

The clear and complete identification of each item is equally important. The same item must not be called by different names at different times; furthermore, the name of each item must be so distinctive that it cannot be confused with any other. This leads in many cases to the careful classification and symbolization of all items in stores. The symbol, being short, distinct, and standing for only one thing, is a convenient means for the accurate identification of stores.

Marks face out.

Identification marks on packages should preferably face out, or be conspicuous. Therefore the end of the package is usually the best place so that when stacked the largest number of labels will show, and furnish a check against packages being misplaced. This is especially important where goods are not tagged. The labelling of individual packages is not so necessary when lots are systematically tagged and placed in definite locations indicated by symbol both on the identification tag and on the balance records.

3—Location.

General considerations.

The elements determining the location of an item are sometimes conflicting. Of course, a large, heavy item, difficult to handle, should be given the shortest possible haul. Similarly, an item easy to handle but carried in large quantities and very frequently used, should be in a convenient location with short haul. The same is true of items which, when issued, have to be specially measured, such as bar-stock, or syrup in barrels.

Special considerations.

There may be, of course, special considerations such as the sensitiveness of explosives, the perishability of meat or other food stuff, or peculiar similarity such as of pipe and bar stock which would clearly point to the necessity of stowing those items together. Whether the location under those circumstances is most convenient is generally secondary to the particular equipment necessary for their proper care. It is sometimes found economical to stow near each other special parts or articles of equipment which are regularly issued together in a group. It is also desirable to keep unserviceable articles separated from serviceable.

Safety.

The stresses which floors will stand must of course be known and allowed for. Whether fire-passages (of 2 ft.) along all walls should be left, depends on local conditions and the nature of the goods. In general, fire-passages are more necessary with block piling, or where stacks run parallel to and adjoin the walls. Fire-passages are less necessary when stacks, with side aisles between every two, run at right angles to walls. In the latter case, the side aisles give direct access to wall space every few feet, and packages next the wall in any given stack may be easily and quickly removed.

4—Accessibility.

Issuable units.

The immediate accessibility of each lot of every item only emphasizes in a different way the fundamental general purpose of stowing, namely, to get at what you want when you want it with the minimum expenditure of time and effort. This means that goods should be stowed as nearly as possible in the units in which they will be issued, even though this requires the breaking of the units in which they are received. This is based on the fact that the time element required for unpacking is less important when the goods are first received than when they are called for issue. As a precaution against unnecessary loss from depreciation, it is obvious that the stock should be kept moving by always using the old lots first.

5—Standard Methods.

In writing.

The importance of establishing in writing some defined methods of placing and removing the various classes of items need not be emphasized. The very effort to determine the methods forces attention and decision for the time being, at least, on the one best way under the circumstances. More than that, it is true that the consistent following of even a poor standard brings better results than the haphazard and uncertain following of the best of standards. The more completely a poor rule is followed, the more clearly will its failings be revealed and the better can it be revised.

Neatness. Exceptions conspicuous.

Standard methods for piling each class of goods will insure neatness and uniformity. Then the exceptions to good piling, by their very conspicuousness, will be their own signal for correction. "Publicity is a potent factor in keeping things right." Therefore, unnecessary covers, doors, and other protections, behind which wrong practice may be concealed should be avoided.

More accurate inspection and count.

Besides leading to precision in handling and making carelessness more noticeable, such uniformity greatly facilitates the accuracy and speed of inspection and count. So far as possible, stores should indicate their own count. Hence the importance of uniformly regular columns, stacks, and blocks. This is the chief reason for preferring cubical to pyramidal piling. The quantity in a full pyramid may be calculated by mathematical formula but difficulties are apt to arise as soon as part of the pyramid is removed. "How much is left" is an all-important question and it should not be necessary to count each article to find out. Piling in uniformly regular columns, stacks, and blocks, with only one last block, stack, column or package containing an odd quantity, is the simple solution of this problem.

Decimal units.

For the same reason, the use of easily calculated decimal units for the quantities in blocks, stacks, columns, and sometimes packages, is desirable. The instruction specifying that piling may be done in single units up to 10 and after that only in multiples of 5 illustrates the point.

Double space.

The allotment to each regularly carried item of double the space needed for each regular lot of the item received is, where sufficient space is available, well worth while. It insures accuracy and simplicity in handling the different lots, each being kept separate and the old lot always being used first. It also results in less frequent need of locating parts of the same item in different places. Where only the single space required for a lot is reserved for it, and a new lot comes before the old lot is used up, it is often necessary to put part, if not all, of the new lot somewhere else, there being no room for it in the space with the old lot. This process, repeated often enough, leads to a constant shifting of the location of given items and results in confusion. In some cases where the storekeeper is responsible for the quantities on hand, he loses sight of some portions of an item and calls for more before he really needs it. This means unnecessary investment and the added liability to loss from spoilage. Some plants have found that the cost of the double space system suggested above was well repaid by protection against such loss. The less intelligent and skilled the help, the greater is the usefulness of the double space system. It is more nearly "fool-proof."

6—Flexibility.

Unit storage spaces.

In few live organizations are conditions the same year after year; in some, the conditions change materially season by season. Hence the importance of flexibility in the arrangement and use of storage equipment. The determination, even at some effort, of a standard rectangular storage unit as the basis for the lay-out of the stores plant is a great help in obtaining this flexibility. Bins, platforms and floor spaces can then be made to correspond to this unit and so be interchangeable. Thus, without affecting in any way the general plan and lay-out, the particular equipment in use may be shifted to meet varying conditions.

Bin sub-divisions.

The same principle applies to the subdivision of bins and will lead to the adoption of a standard unit bin of such inside dimensions that it will hold the greatest variety of standard removable subdivisions. For instance, a bin 24½" x 24½" x 18" inside, opening on the first two dimensions, gives opportunity for a wide variety of subdivisions 18" deep whose other two outside dimensions will be even fractions of 24".

Emergency bins.

For emergency use, bins may be improvised by stacking empty packing cases of uniform size back to back. Such double rows should preferably run at right angles to the long side of the building.

7—Planning.

The importance of accomplishing the most with every man-hour of labor as well as every dollar of expense in the nation's work of winning the war is the measure of the importance of careful stowing. Hours of labor and dollars of expense can be avoided by intelligent planning ahead. The storekeeper must pre-determine and control his results instead of letting conditions take him by surprise and find him unprepared. Where he has the planning of new storage areas he will find it pays, for best results and a minimum waste of space and operating expense, to observe the following sequence:

Method for planning new areas.

(a) The listing and classification of all items according to
  1. Measurements
  2. Difficulty of handling
  3. Frequency of use
  4. Special considerations, as of sensitiveness, perishability or of peculiar similarity
  5. Quantities to be carried

(b) Determination of proper unit storage space

(c) Determination of proper aisle spaces

(d) Determination of proper lay-out of storage and aisle space with general location of items and calculation of total space needed.

(e) Lastly, the planning of structures so that entrances, aisles, posts, platforms, windows, and other necessary features will not interfere with but will facilitate the most desirable lay-out of the stores themselves.

PART IV.—GENERAL INSTRUCTIONS FOR HANDLING STORES.

Counting.

Before or during stowing.

1. All goods will be counted before or during stowing, and the quantity entered on the tag.

Placing.

Storage space.

2. Stores are stowed only in the spaces reserved for the purpose. This means that window sills, ledges, floors, aisle spaces, etc., are not to be used either permanently or temporarily for keeping goods unless the tag on the goods bears the signature of the proper official authorizing the use of such space for that purpose. Tools or equipment in regular use in store rooms will be provided with special places, marked so as to show the purpose for which reserved.

Space for one item.

3. The space allotted to any one item will be enough to hold the maximum expected on hand at one time, with each lot distinct. e.g. If the normal lot would occupy 1½ rows, and usually arrives when 1-3 of the previous lot (or ½ row) is left, the total space reserved for the item would be 2 rows. (See Figure 1.)

Placing.

4. The placing of any item of stores depends on the shape and character of the article, and the nature of the storage place. On the floor are placed cases of such size and weight as to be apt to break a platform in handling. All other stores except those stowed in bins or on racks are placed on platforms. These are largely goods of bulk and weight, such as sometimes require more than one man to handle and

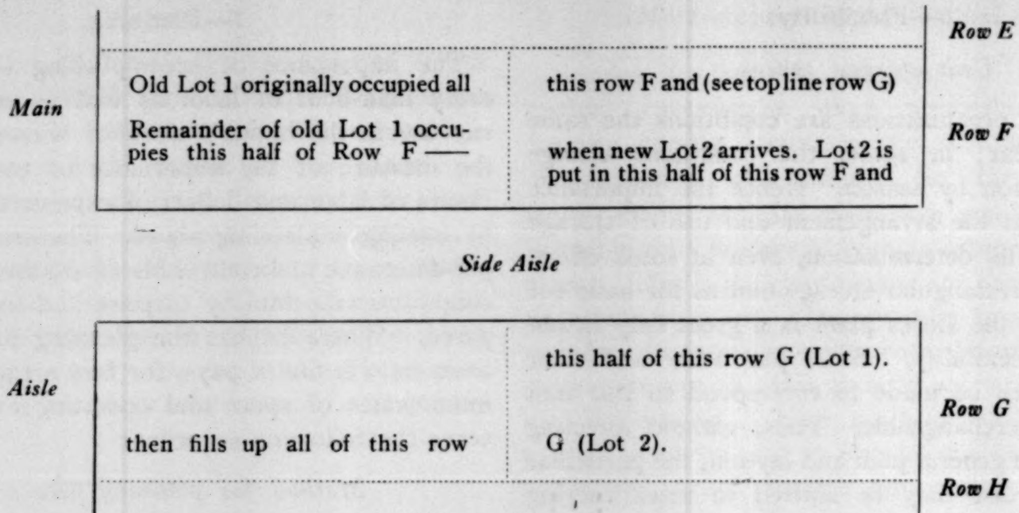

Row E
Main
Aisle
Old Lot 1 originally occupied all
this row F and (see top line row G)
Remainder of old Lot 1 occupies this half of Row F —
when new Lot 2 arrives. Lot 2 is put in this half of this row F and
Row F
Side Aisle
this half of this row G (Lot 1).
then fills up all of this row
G (Lot 2).
Row G
Row H

FIGURE 1

pile, (e.g., barrels, bags, bales, bundles, and ordinary cases and crates). Small stores, such as those in small boxes, cartons, and packages, and loose supplies are put in bins. Articles of unwieldy length, like iron piping, are placed on racks.

Accessibility.

5. Goods will be placed so as to be as easily accessible as possible, those more frequently used being in the handier locations.

Minimum handling.

6. Consistent with the above, they will be placed so as to require as little handling as possible in receiving, stowing and removing. Old lots should not have to be disturbed when new lots are placed. Other things being equal, heavy bulky goods will have the shortest haul.

Concentrating.

Rows.

7. In stowing a bulky item of stores in quantity, effort will be made to concentrate it. Thus two rows opposite each other (across a side aisle) will be filled in preference to two adjacent rows. Any excess over two rows full may then be stowed in the aisle between. This saves space to almost the extent of solid block piling, yet preserves the desirably flexible row arrangement with its maximum of direct accessibility.

Side Aisles.

8. Side aisles may be used for stowing only when the rows on either side are full of the same material.

Main Aisles.

9. Main aisle space adjoining a wall may be filled out to parallel full rows and aisles of the same

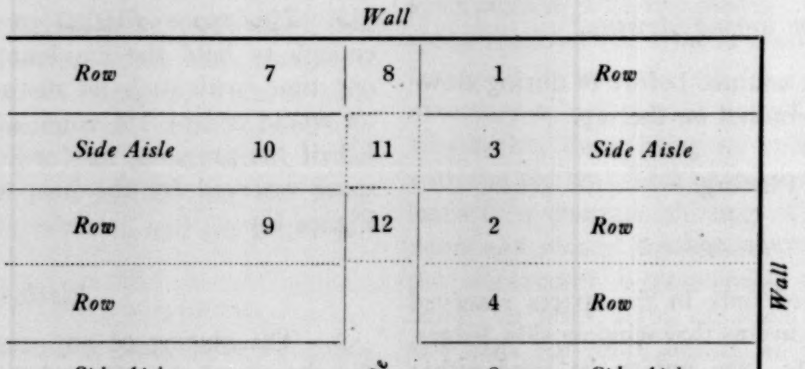


FIGURE 2

material on either side. Platforms will, when practicable, be placed for goods stowed in aisles.

Figure 2 illustrates the order in which rows and aisles may be filled with large lot of one item. Removals will be in reverse order. (See paragraph 24).

Piling.

Spoilage.

10. Articles should never be stowed in a position which might cause injury to them. Thus sheets of unprinted paper should lie flat, brooms should stand on handle end, or hang, and barrels should stand on end. Likewise, placing articles so they project from the edge of a bin or platform is to be avoided. In general, articles will be kept off the floor or the ground. In placing items subject to deterioration from heat and dryness or from cold and dampness, it will be remembered that air near the ceiling is usually warmer and dryer than near the floor.

Height.

11. In stowing goods, the greatest economy of space is secured by tiering in cubical stacks and blocks as high as is consistent with stability, thus leaving a maximum area for different groups and kinds of articles. Where economy of space is not critical, economy of time and effort are more important, and goods will be tiered only as high as an ordinary man can reach. Five feet to the top of the next to last tier is a normal height for packages not exceeding 100 lbs. As far as possible men should work singly, rather than in groups.

Shape—Cubical vs. pyramidal.

12. Where it is possible to choose between cubical and pyramidal piling of goods, the cubical method will be given preference.

Cubical piling has the following five advantages:

1. More economical in use of space.
2. Easier to keep uniform and regular.
3. Easier to inspect.
4. Easier to count.
5. Less spoilage from weather, if uncovered.

Pyramidal piling has two advantages:

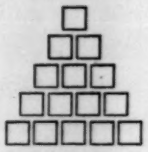
1. Simpler and easier to secure stable tiering of cylindrical or other rolling articles, such as shells, by bracing the bottom tier only of each stack. Cubical tiering of such goods requires bracing the stack all the way up.

2. Easier to cover from weather, because of its shape like a peaked roof.

Where pyramidal piling is a necessity,

$$\text{No. in full stack} = \frac{\text{No. on bottom tier x (No. of tiers} + 1)}{2}$$

e.g. For a full pyramidal stack with 5 in bottom tier



$$\text{No. in stack} = \frac{5 \text{ x } (5+1)}{2} = \frac{5 \text{ x } 6}{2} = \frac{30}{2} = 15$$

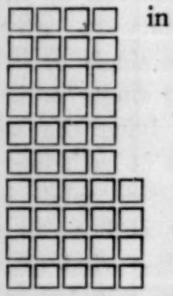
The number in any block, whether pyramidal or cubical, will be the number in one full stack times the number of full stacks in the block.

Uniformity.

13. Full columns, stacks or blocks of any one item will be kept uniform for that item. Only the last column, stack or block may remain incomplete, containing odd quantities. This will add both to neatness, and to ease and accuracy in counting.

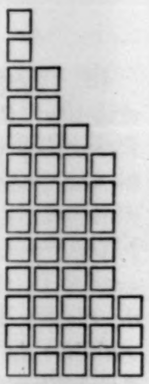
e.g.

Correct method
of piling 44
in 1 stack



Front view—

Incorrect
method
of piling 44
in 1 stack



Front
view—

Group Piling.

14. Stores are piled singly or in multiples of five. Goods may be piled singly up to ten in a column. Beyond this the columns are made as high as the space will permit but of whole groups of five only. Groups are not broken to fill in a remaining space too small for a whole group. Thus every column of articles small enough to be piled in groups of five will contain some multiple of five and will be uniform for that article. For instance, if a bin holds 24 packages of letterheads piled snug to the top, the column will be made of 20 packages only, viz., 4 groups of 5 each.

Stowing Area.

15. In any area to be filled, such as a platform unit, stowing is commenced at the back left-hand corner, and brought forward, each row of goods being completed to the front before a new row is started.

Tiering is done as soon as the nature of the goods permits and as high as possible so long as the stacks are stable, the uniform groups are preserved, and the stack does not come too near the ceiling. Space will be left for the proper working of the sprinkler pipes (in this case . . . inches), and for properly removing (such as by upending) the goods on the top tier.

Stowing volume.

16. In any cubic space to be filled, such as a bin, stowing is commenced at the back left-hand corner, and carried on vertically until one column is completed. This is made the first of a row of such columns brought to the front and completed. The second row of columns will commence as did the first, in the farthest left-hand corner of the remaining available space, and be built up and forward in the same manner.

Separation of lots.

17. Different items or different lots of the same item will be kept distinct. If placed in the same storage space, they will be separated by a space of at least one inch if in bins, or three inches if on platforms. Each lot of each item has its own separate tag and lot number.

Direction.

18. Goods will be placed all one way unless for stability it is necessary to reverse or cross-pile. *Reversing* will be done singly or in groups, according as the goods are piled singly or in groups, the same dimensions, however, lying the same way. *Cross-piling,* or laying goods in each tier or course at right angles to those just below, while increasing stability, decreases accessibility and sureness of count. As stability is generally less vital than accessibility and flexibility, cross-piling will be resorted to only in special cases. Where ventilation is required, as in piling lumber, cross-bars separating each course will be used. Thus the goods in all the courses may still lie all one way. The best way in general for goods to lie is with their ends out towards the aisle into which they will be withdrawn. If, however, space is economized to a marked degree (at least 25%) by placing the goods in some other way, it may be done.

Labels.

19. Labels, or other means of identification, will be placed all one way, showing outward if consistent with other rules.

Wrappings.

20. Articles with defective wrapping will be placed last, in order that they may be removed first. The person stowing goods is responsible for seeing that the tying or wrapping on packages is in as good condition as his facilities enable him to secure. This includes the putting on of new wrappings when necessary and feasible.

Maximum.

21. The maximum quantity ordinarily stowed will occupy not more than 75% of the space available. The remaining space is reserved for times of special need.

Removing.

Parts of one lot.

22. In removing goods from storage, in any one lot the last goods to be put in place are removed first, and further removals are made in just the reverse order to that in which they were placed. This means the cleaning up of incomplete before complete columns, stacks and blocks are touched.

More than one lot.

23. In the case of more than one lot of any one item, the lots are drawn from in order of age commencing with the oldest, unless otherwise specified on the issue. Not until all the goods of one lot are removed from any part of a storage space and the tag removed, is that part available for stowing a new lot.

Goods concentrated in aisles.

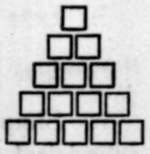
24. Where goods have been concentrated by stowing in side aisles between regular storage rows, (see paragraphs 7-9), removals will be made first from aisle spaces. No goods will be removed from a regular row until adjoining aisle spaces have been entirely cleared.

Pyramidal blocks.

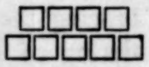
25. Removals from a pyramidal block will not be from the side slopes or from along the top, but will be stack by stack from the front. Thus there will be not more than one incomplete stack at any one time, all stacks behind the front one being complete. Removals from any one stack will be tier by tier from the top, so as not to disturb existing stability, or any braces at the bottom tier.

e.g.

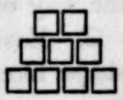
Full Stack of 15



Correct removal of 6, leaving 9



Incorrect removal of 6, leaving 9



THE METHOD OF MAKING ROUTE CHARTS AND ROUTE SHEETS

How the Operations of Assembling a Machine are Controlled and Graphically Charted

By John W. Carter[1]

One of the most important phases of Scientific Management and one which ranks among the first in order is the establishment of a "routine" in which are shown the various processes through which any unit or combination of units must pass in order to be converted from the raw material to the finished product. It includes an analysis of work which involves the provision of sufficient quantities of raw material in advance and their proper assignment; the sequence of operations; the sub-division of labor; the assignment of men and materials to machines, and the making of time or motion studies. All these must be simplified to such an extent that they can be quickly and easily comprehended by the novice as well as by the experienced engineer.

"Routine" is a very abused term and is very often misconstrued for red tape, but obviously there is a vast difference. Red tape is something to eliminate, while a well laid "Routine" is an indispensable asset. While numerous arguments might be offered to substantiate this assertion, it is only possible in a paper of this length to enumerate a few reasons for its maintenance.

First—As we all know, Scientific Management is efficiency; efficiency is co-operation or team work, and to quote what has already been said, "efficient team work in any organization is only possible when a clear and complete understanding of what is to be done exists between all members." We must all pull together, not in opposite directions, but the same way and at the same time. To know when, how and in what direction to pull is the chief purpose of the "routine."

Second—Under Taylor System management men are paid a bonus, but a bonus or task system can only become operative when a definite knowledge of what is to be done is available. In other words, to make a systematic time study we must first have a well defined task. This information is conveyed to the time study department through the medium of the routine or route chart.

Again—A "routine" is a perpetual inventory of analyses of various products with their methods of manufacture, which becomes invaluable in the duplication of orders and estimating for work.

Just a word about the control of work. So long as the supervision of work is vested in several departments, each with entirely different conditions and perhaps variable attitudes of executives, there can be no accurate control of work. No two heads of departments have time to be very much interested in each other's work,—they are too much absorbed in their own. There might be over production in one department and the reverse in the other. No correct schedule could be laid out by which each unit or number of units could be started out at a period which would insure their being delivered to the assembly floor in proper sequence so that the combination of the several units would be in harmony. So this initiative must be removed from the several departments and concentrated at one point, namely, the planning department, which in turn must be governed by a "routine."

From the time a manufacturing order (Figure 1) leaves the drafting room until the finished product is either shipped or placed in stock, the path of progress even to the minutest details must be laid out so that when once started out each unit or component part will find its own way to the proper destination without the continuous supervision of executives.

The planning department must know the exact duration of each operation and its sequence in order to provide steady employment for men and machines; to regulate the volume of work so that congestion or scarcity of work will be reduced to a minimum or be entirely eliminated; to provide periodical inspection; to carry in stores sufficient quantities of raw materials such as are needed for immediate use.

There is an endless variety of products which do not require an elaborate analysis, some being so simple that route charts are unnecessary and the few operations required to produce the finished article can be contained on a single route sheet. But in the more complex industries, such as engine or machine building, in order to provide for the multitudinous functions incident to such production, it is necessary to make route charts and route sheets, to an exposition of the principles of which I wish to devote the balance of this paper.

Let me first refer to the analysis of work which is the most important phase of the subject and one which requires a combination of general shop experience, a familiarity with the equipment available, an analytical mind and common sense. Upon the degree of accuracy of this analysis depends the success or failure of all subsequent effort; therefore careful and mature deliberation is essential.

Under the old method it was customary to build a machine up, piece by piece, that is, as fast as parts arrived in the assembly floor they were placed in their

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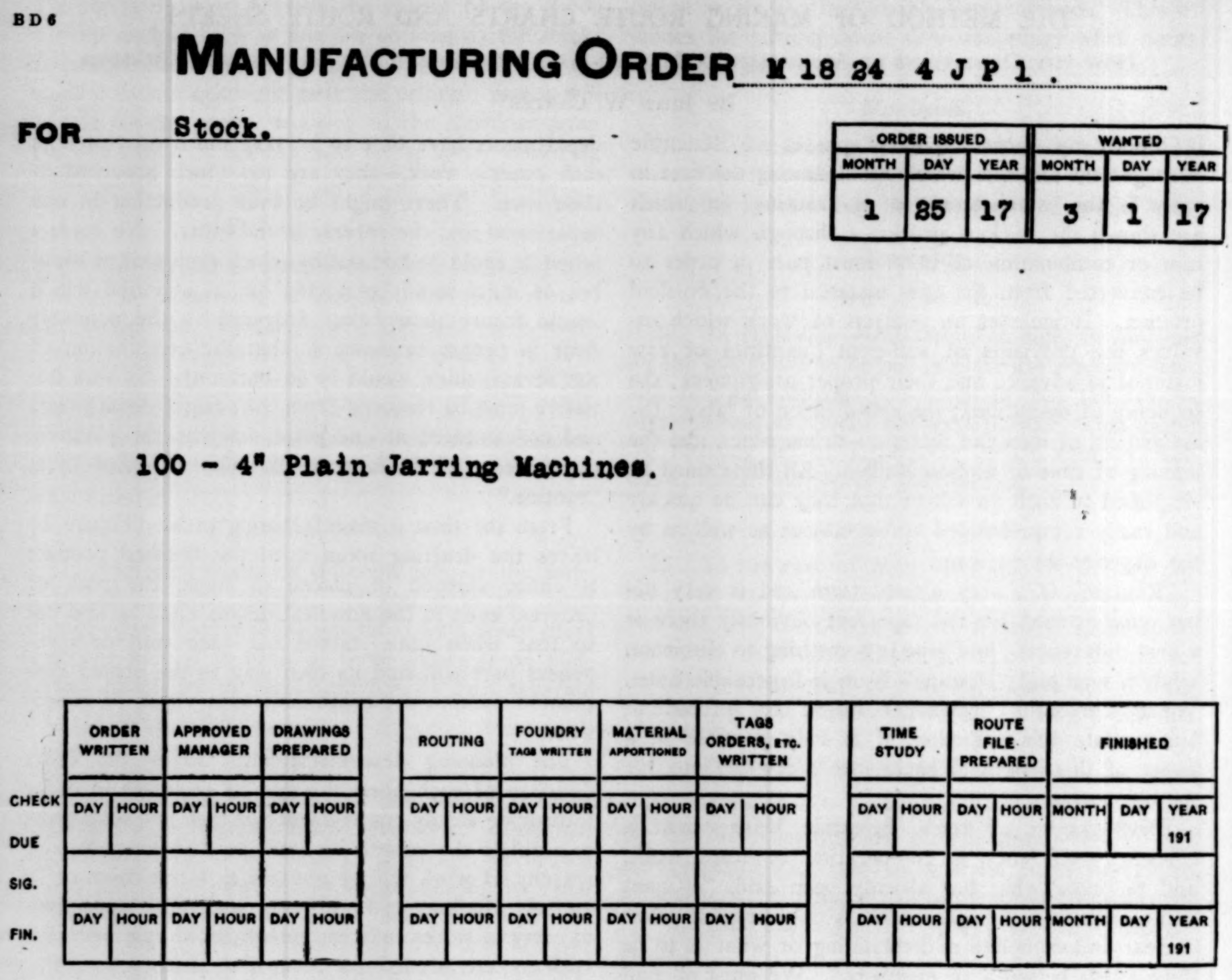
[1] Tabor Manufacturing Co., Philadelphia, Pa.



BD 6

MANUFACTURING ORDER M 18 24 4 J P 1.

FOR Stock.

ORDER ISSUED			WANTED		
MONTH	DAY	YEAR	MONTH	DAY	YEAR
1	25	17	3	1	17

100 - 4" Plain Jarring Machines.

	ORDER WRITTEN		APPROVED MANAGER		DRAWINGS PREPARED			ROUTING		FOUNDRY TAGS WRITTEN		MATERIAL APPORTIONED		TAGS ORDERS, ETC. WRITTEN			TIME STUDY		ROUTE FILE PREPARED		FINISHED		
CHECK	DAY	HOUR	DAY	HOUR	DAY	HOUR		DAY	HOUR	DAY	HOUR	DAY	HOUR	DAY	HOUR		DAY	HOUR	DAY	HOUR	MONTH	DAY	YEAR
DUE																							191
SIG.																							
FIN.	DAY	HOUR	DAY	HOUR	DAY	HOUR		DAY	HOUR	DAY	HOUR	DAY	HOUR	DAY	HOUR		DAY	HOUR	DAY	HOUR	MONTH	DAY	YEAR
																							191

FIGURE 1

proper location and the machine was erected as a whole, a slow process compared with that of the Taylor plan, which is to divide the general assembly into groups, each group being worked entirely independently of the others, and the several groups united as a whole at a subsequent period.

These groups, as well as their component parts, must come together in their proper sequence. Figure 2 may help to visualize the method.

There is hardly any complicated product in which the general assembly cannot be divided into groups as heretofore mentioned. The method of dividing it into groups; the subdivision of groups into operations; the operations into units and the analysis of these components to ascertain what processes are necessary to convert the raw material into these several units, would very much resemble the outline of a tree.

For example, the trunk would represent the final or miscellaneous assembly; the boughs the groups; the branches the group operations, and the twigs the component parts of each operation, while the leaves would represent the finishing touches such as painting, boxing, etc. It will be noticed that the boughs are not all joined to the trunk at equal intervals, while in some instances two come together at about the same place. This is also true of group assembly. In some instances two or more groups may be united at the same time and others follow on in logical order. The same is true of operations, sometimes as high as five or six can be going on at the same time. Now compare this with the layout to the left of the illustration, which is intended to represent a machine whose assembly would consist of three groups (enclosed by heavy lines) each one entirely independent of the other, and a final or miscellaneous group, and you will note the familiarity. Each one of these groups contains a number of assembly operations appearing in the order in which they can be done, *viz.*: Group Assembly Op. Nos. 1, 2, 3, etc., hereafter designated GA No. 1, GA No. 2, GA No. 3, etc.

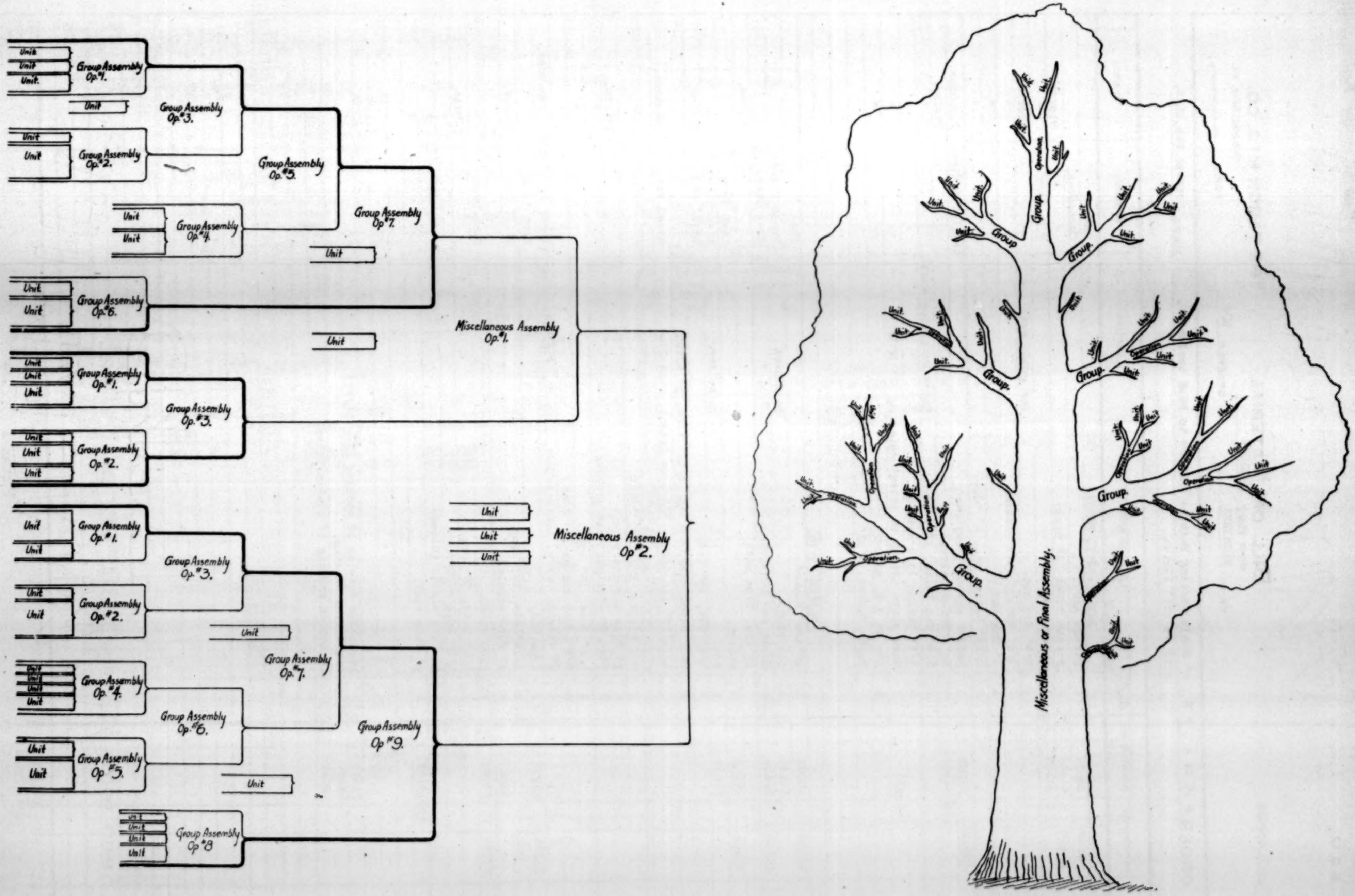
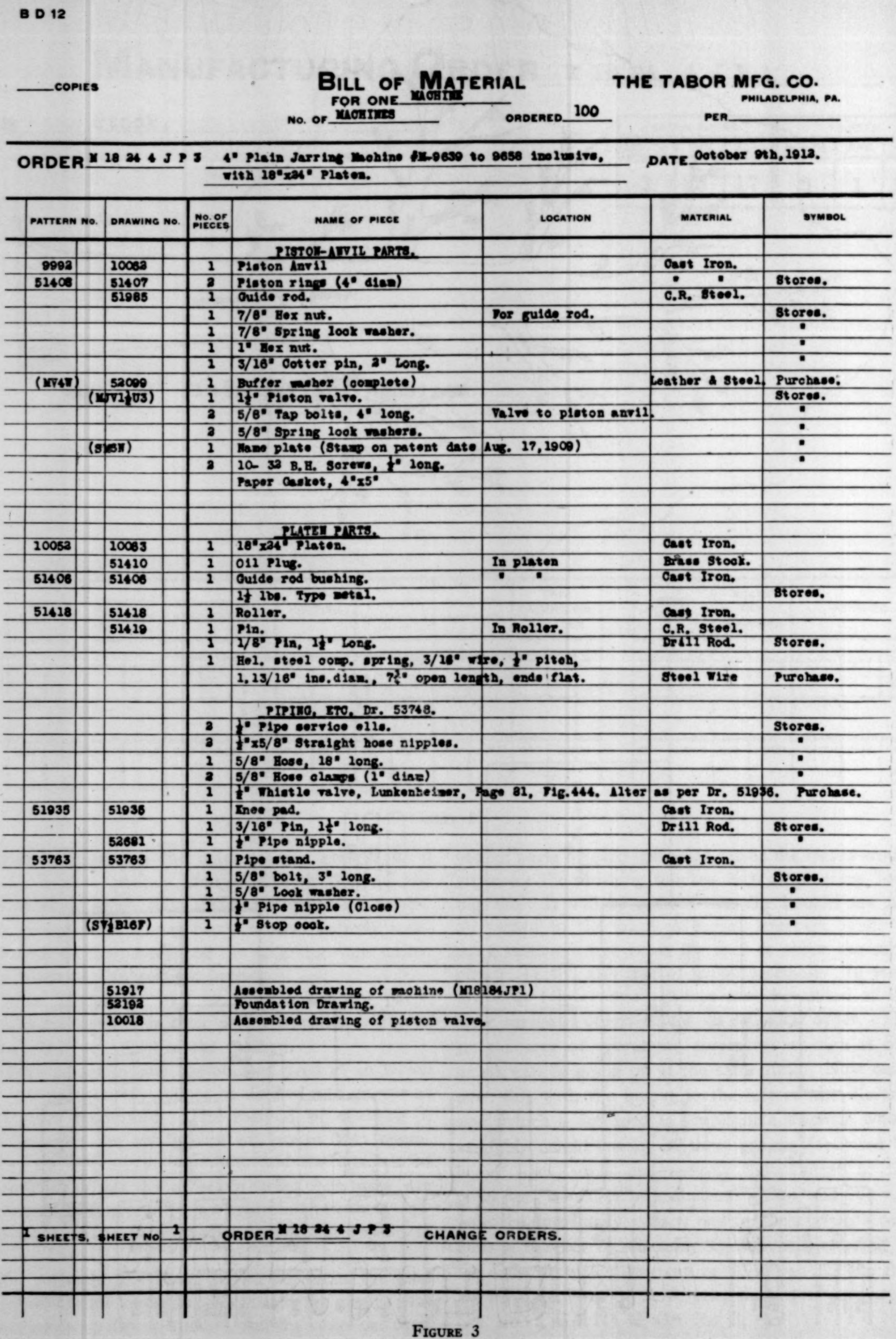

Unit
Unit
Unit.
Group Assembly Op.#1.
Unit
Group Assembly Op.#3.
Unit
Unit
Group Assembly Op.#2.
Group Assembly Op.#5.
Unit
Unit
Group Assembly Op.#4.
Group Assembly Op.#7.
Unit
Unit
Unit
Group Assembly Op.#6.
Unit
Miscellaneous Assembly Op.#1.
Unit
Unit
Unit
Group Assembly Op.#1.
Group Assembly Op.#3.
Unit
Unit
Unit
Group Assembly Op.#2.
Unit
Unit
Unit
Miscellaneous Assembly Op#2.
Unit
Unit
Group Assembly Op.#1.
Group Assembly Op.#3.
Unit
Unit
Group Assembly Op.#2.
Unit
Group Assembly Op.#7.
Unit
Unit
Unit
Unit
Group Assembly Op.#4.
Group Assembly Op.#6.
Group Assembly Op#9.
Unit
Unit
Group Assembly Op#5.
Unit
Unit
Unit
Unit
Unit
Group Assembly Op#8
Unit
Operation
Group.
Group
Group.
Group.
Group.
Group.
Group.
Operation
Miscellaneous or Final Assembly.

Figure 2



B D 12

_____COPIES

BILL OF MATERIAL
FOR ONE MACHINE
NO. OF MACHINES ORDERED 100

THE TABOR MFG. CO.
PHILADELPHIA, PA.
PER_____________

ORDER M 18 24 4 J P 3 4" Plain Jarring Machine #M-9639 to 9658 inclusive, with 18"x24" Platen.
DATE October 9th, 1913.

PATTERN No.	DRAWING No.	No. OF PIECES	NAME OF PIECE	LOCATION	MATERIAL	SYMBOL
			PISTON-ANVIL PARTS.			
9992	10063	1	Piston Anvil		Cast Iron.	
51408	51407	2	Piston rings (4" diam)		" "	Stores.
	51985	1	Guide rod.		C.R. Steel.	
		1	7/8" Hex nut.	For guide rod.		Stores.
		1	7/8" Spring lock washer.			"
		1	1" Hex nut.			"
		1	3/16" Cotter pin, 2" Long.			"
(MV4W)	52099	1	Buffer washer (complete)		Leather & Steel.	Purchase.
	(MJV1½U3)	1	1½" Piston valve.			Stores.
		2	5/8" Tap bolts, 4" long.	Valve to piston anvil.		"
		2	5/8" Spring lock washers.			"
	(SMSN)	1	Name plate (Stamp on patent date	Aug. 17, 1909)		"
		2	10-32 B.H. Screws, ½" long.			"
			Paper Gasket, 4"x5"			
			PLATEN PARTS.			
10052	10083	1	18"x24" Platen.		Cast Iron.	
	51410	1	Oil Plug.	In platen	Brass Stock.	
51406	51406	1	Guide rod bushing.	" "	Cast Iron.	
			1½ lbs. Type metal.			Stores.
51418	51418	1	Roller.		Cast Iron.	
	51419	1	Pin.	In Roller.	C.R. Steel.	
		1	1/8" Pin, 1½" Long.		Drill Rod.	Stores.
		1	Hel. steel comp. spring, 3/16" wire, ½" pitch,			
			1,13/16" ins.diam., 7¾" open length, ends flat.		Steel Wire	Purchase.
			PIPING, ETC. Dr. 53748.			
		2	½" Pipe service ells.			Stores.
		2	½"x5/8" Straight hose nipples.			"
		1	5/8" Hose, 18" long.			"
		2	5/8" Hose clamps (1" diam)			"
		1	½" Whistle valve, Lunkenheimer, Page 81, Fig.444. Alter	as per Dr. 51936.		Purchase.
51935	51936	1	Knee pad.		Cast Iron.	
		1	3/16" Pin, 1¼" long.		Drill Rod.	Stores.
	52681	1	½" Pipe nipple.			"
53763	53763	1	Pipe stand.		Cast Iron.	
		1	5/8" bolt, 3" long.			Stores.
		1	5/8" Lock washer.			"
		1	½" Pipe nipple (Close)			"
	(SV½B16F)	1	½" Stop cock.			"
	51917		Assembled drawing of machine (M18184JP1)			
	52192		Foundation Drawing.			
	10018		Assembled drawing of piston valve.			

1 SHEETS, SHEET No 1 ORDER M 18 24 4 J P 3 CHANGE ORDERS.

FIGURE 3

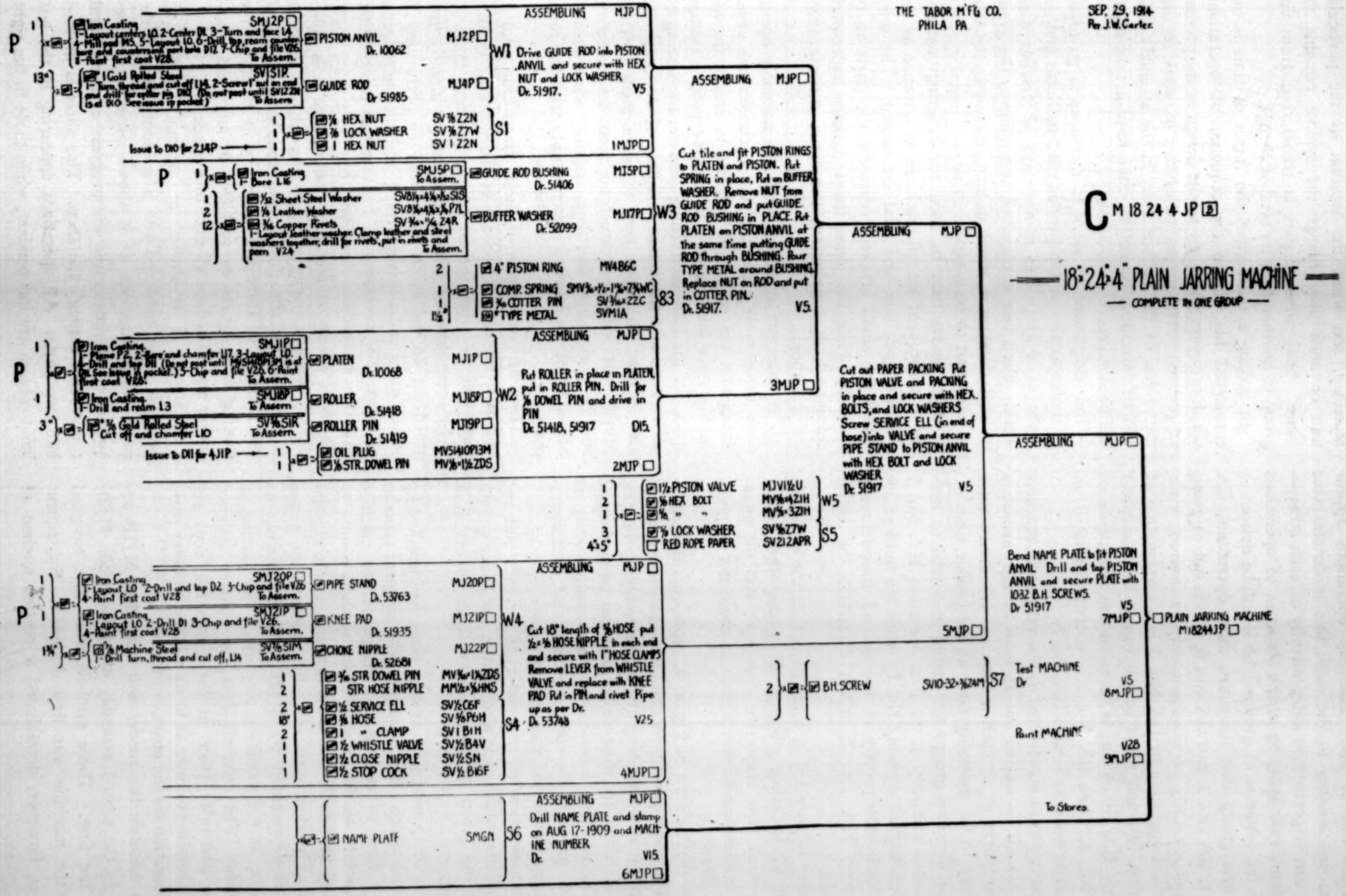

THE TABOR M'F'G CO.
PHILA PA
SEP. 29, 1914.
Per J.W. Carter.
C M 18 24 4 JP
18"x24"x4" PLAIN JARRING MACHINE
COMPLETE IN ONE GROUP
P
Iron Casting
1-Layout centers L0. 2-Center DI. 3-Turn and face L4. 4-Mill pad M5. 5-Layout L0. 6-Drill, tap, ream counterbore and countersink part hole D12. 7-Chip and file V26. 8-Paint first coat V28.
SMJ2P ☐
To Assem.
PISTON ANVIL
Dr. 10062
MJ2P ☐
13"
1 Cold Rolled Steel
1-Turn, thread and cut off L14. 2-Screw 1" nut on end and drill for cotter pin D10. (Do not post until SV1Z2N is at D10. See issue in pocket.)
SV1S1P
To Assem.
GUIDE ROD
Dr. 51985
MJ4P ☐
7/8 HEX NUT SV7/8Z2N
7/8 LOCK WASHER SV7/8Z7W
1 HEX NUT SV1Z2N
S1
Issue to D10 for 2J4P
1MJP ☐
W1
ASSEMBLING MJP ☐
Drive GUIDE ROD into PISTON ANVIL and secure with HEX NUT and LOCK WASHER
Dr. 51917.
V5
Iron Casting
1-Bore L16
SMJ5P ☐
To Assem.
GUIDE ROD BUSHING
Dr. 51406
MJ5P ☐
1/32 Sheet Steel Washer
1/4 Leather Washer
3/16 Copper Rivets
1-Layout leather washer. Clamp leather and steel washers together, drill for rivets, put in rivets and peen V24
To Assem.
BUFFER WASHER
Dr. 52099
MJ17P ☐
W3
4" PISTON RING MV486C
COMP. SPRING
3/16 COTTER PIN
TYPE METAL SVM1A
S3
ASSEMBLING MJP ☐
Cut tile and fit PISTON RINGS to PLATEN and PISTON. Put SPRING in place, Put on BUFFER WASHER. Remove NUT from GUIDE ROD and put GUIDE ROD BUSHING in PLACE. Put PLATEN on PISTON ANVIL at the same time putting GUIDE ROD through BUSHING. Pour TYPE METAL around BUSHING. Replace NUT on ROD and put in COTTER PIN.
Dr. 51917.
V5.
3MJP ☐
Iron Casting.
1-Plane P2. 2-Bore and chamfer L17. 3-Layout L0. 4-Drill and tap D11 (Do not post until MV5410P13M is at D11. See issue in pocket.) 5-Chip and file V26. 6-Paint first coat V28.
SMJ1P ☐
To Assem.
PLATEN
Dr. 10068
MJ1P ☐
Iron Casting.
1-Drill and ream L3
SMJ18P ☐
To Assem.
ROLLER
Dr. 51418
MJ18P ☐
3"
5/8 Cold Rolled Steel
1-Cut off and chamfer L10
SV5/8S1R
To Assem.
ROLLER PIN
Dr. 51419
MJ19P ☐
Issue to D11 for 4J1P
OIL PLUG MV5410P13M
5/8 STR. DOWEL PIN
W2
ASSEMBLING MJP ☐
Put ROLLER in place in PLATEN, put in ROLLER PIN. Drill for 1/8 DOWEL PIN and drive in PIN
Dr. 51418, 51917
D15.
2MJP ☐
1 1/2 PISTON VALVE
5/8 HEX BOLT
5/8 " "
5/8 LOCK WASHER SV5/8Z7W
RED ROPE PAPER SV212APR
W5
S5
ASSEMBLING MJP ☐
Cut out PAPER PACKING. Put PISTON VALVE and PACKING in place and secure with HEX. BOLTS, and LOCK WASHERS. Screw SERVICE ELL (in end of hose) into VALVE and secure PIPE STAND to PISTON ANVIL with HEX BOLT and LOCK WASHER
Dr. 51917
V5
5MJP ☐
Iron Casting
1-Layout L0. 2-Drill and tap D2. 3-Chip and file V26. 4-Paint first coat V28
SMJ20P ☐
To Assem.
PIPE STAND
Dr. 53763
MJ20P ☐
Iron Casting
1-Layout L0. 2-Drill D1. 3-Chip and file V26. 4-Paint first coat V28
SMJ21P ☐
To Assem.
KNEE PAD
Dr. 51935
MJ21P ☐
1 3/4"
5/8 Machine Steel
1-Drill, turn, thread and cut off, L14
SV5/8S1M
To Assem.
CHOKE NIPPLE
Dr. 52681
MJ22P ☐
W4
3/16 STR DOWEL PIN
STR HOSE NIPPLE
1/2 SERVICE ELL SV1/2C6F
5/8 HOSE SV5/8P6H
1 " CLAMP SV1B1H
1/2 WHISTLE VALVE SV1/2B4V
1/2 CLOSE NIPPLE SV1/2SN
1/2 STOP COCK SV1/2B16F
S4
ASSEMBLING MJP ☐
Cut 18" length of 5/8 HOSE put 1/2x5/8 HOSE NIPPLE in each end and secure with 1" HOSE CLAMPS. Remove LEVER from WHISTLE VALVE and replace with KNEE PAD. Put in PIN and rivet Pipe up as per Dr.
Dr. 53748
V25
4MJP ☐
NAME PLATE SMGN
S6
ASSEMBLING MJP ☐
Drill NAME PLATE and stamp on AUG 17-1909 and MACHINE NUMBER
Dr.
V15.
6MJP ☐
2
B.H. SCREW SV10-32x3/8Z4M
S7
ASSEMBLING MJP ☐
Bend NAME PLATE to fit PISTON ANVIL. Drill and tap PISTON ANVIL and secure PLATE with 1032 B.H. SCREWS.
Dr 51917
V5
7MJP ☐
Test MACHINE
Dr
V5
8MJP ☐
Paint MACHINE
V28
9MJP ☐
To Stores.
☐ PLAIN JARRING MACHINE
M18244JP ☐

FIGURE 4

When two or more assembly operations appear under one another in the same line it denotes that they can be performed independently of each other,—the same rule applying to the sequence of operations as to the sequence of groups. So it will be noticed in the first group that there are three operations, GA No. 1, GA No. 2, and GA No. 6, which can be going on independently or simultaneously as desired, while the third operation or GA No. 3 is a combination of the first two and must be performed in subsequent order. GA No. 4 can be done at the same time as GA No. 3, while GA No. 5 is a combination of all preceding ones, as is also GA No. 7.

The units are represented by the very small brackets and can all be started out as soon as raw materials are available or at such a time as will insure their delivery to the assembly floor at the proper time.

The first two groups are united in a final or miscellaneous assembly in the first operation MA No. 1 (Miscellaneous assembly No. 1) while the third group is added subsequently in the second miscellaneous operation MA No. 2, which completes the entire process.

There is provided in connection with the drawings a bill of materials (Figure 3) giving the list of parts with their respective drawings; also the quantities and classes of stores such as could not be given on a drawing.

The chart shown in Figure 4, represents the analysis of a small jarring moulding machine complete in one group and consisting of nine assembly operations, four of which are independent and can be performed in consecutive or reverse order or simultaneously as desired, provided the component parts of each operation are available on the assembly floor.

The assignment of raw materials for each unit and the various machines is also shown, the exact quantities being given so that there will be no materials wasted.

Each component part or unit must be identified by a symbol which after once properly assigned remains for all time so long as the design of the machine continues to be the same. These symbols cannot be assigned arbitrarily but must conform to the classification of worked materials. For instance the piston anvil is represented by MJ2P, the explanation of which is, M for moulding machine, J for jarring, P for plain. The numeral 2 is the number assigned to the particular piece in the group but does not signify any importance as to its relation to other parts or its location on the chart.

For instance the reader will note that MJ1P appears in the second assembly operation while MJ2P is in the first. These symbols were first assigned when the machine was first designed. Subsequent changes, however, necessitated a revised method of assembly, and while the location of the particular unit or units may change the symbol remains the same. Only when a part is transferred from one group to another does its symbol change.

In making a route chart the factor of time is not considered but rather the sequence of operations, which is governed entirely by the design of the product in question. The proper scheduling of work so that the arrival of the various units in the assembly floor will be coincident cannot be done until a time study has been taken.

The assignment of work to machines is governed by the capacities of the various machine tools and the grade of work. This is also true of vise or floor work. Each vise is classified according to the grade of work done on it, which in turn determines the type of workman to be assigned to it.

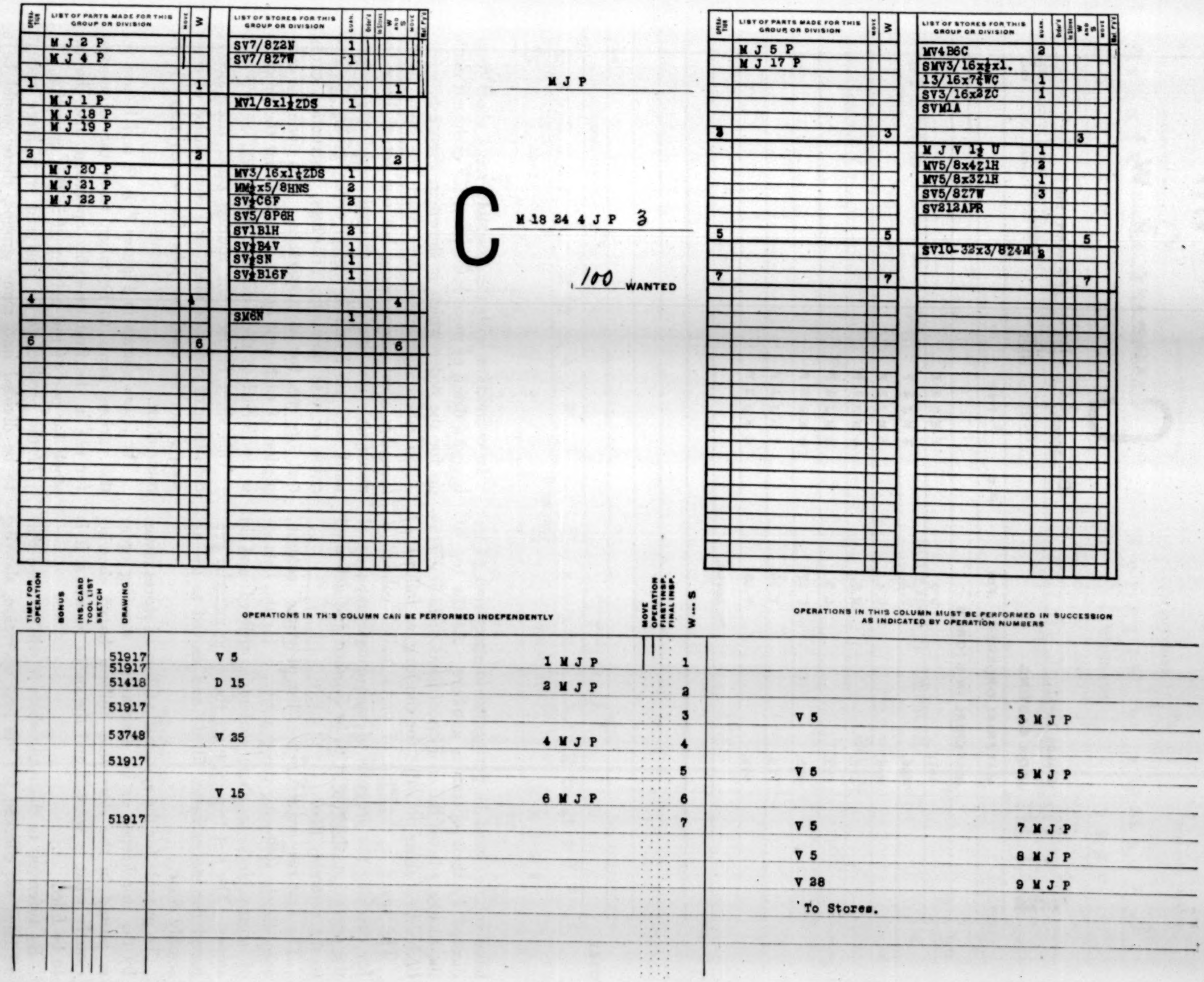
These charts may be used for ordering material for a subsequent lot of machines in advance as the quantities per unit and total are shown. The units within the small brackets represent the parts to be made up while the items listed directly underneath are issued, in conjunction therewith, directly from the storeroom.

The numerals appearing with the assembly operations namely—W1 and S1 run in consecutive order throughout the entire job and are to enable the assembly floor stock keeper to provide proper storage space for the time intervening between the issuing of such stores and the actual assembly of the same. It also enables the move men to place them in their proper bins without instructions from an executive, and the workman to find them instantly when needed. Storage bins are labelled in conformity with the route chart.

There are two copies of these charts blue printed, one as a record and for use in the planning department and the other for use on the assembly floor.

In order that the several functions, as already provided for on the route chart, may be performed in logical order and a correct record made of the progress of work, it is necessary to transfer this information, in a very much more simplified form, to a route sheet. As these sheets or files are manipulated by a functionary whose capacity is purely clerical, and in order to provide for the instant and speedy checking of the same, it is absolutely necessary to eliminate the dealing with figures or problems of any kind whatsoever and to reduce all data to a check line.

In Figure 5 is shown an assembly route and progress sheet combined and is a counterpart of the route chart inasmuch as it shows correctly the sequence of operations and the progress of the several components through the shop. This sheet is divided into two parts. All operations appearing in the left hand column are independent, while those in the right



M J P

C M 18 24 4 J P 3

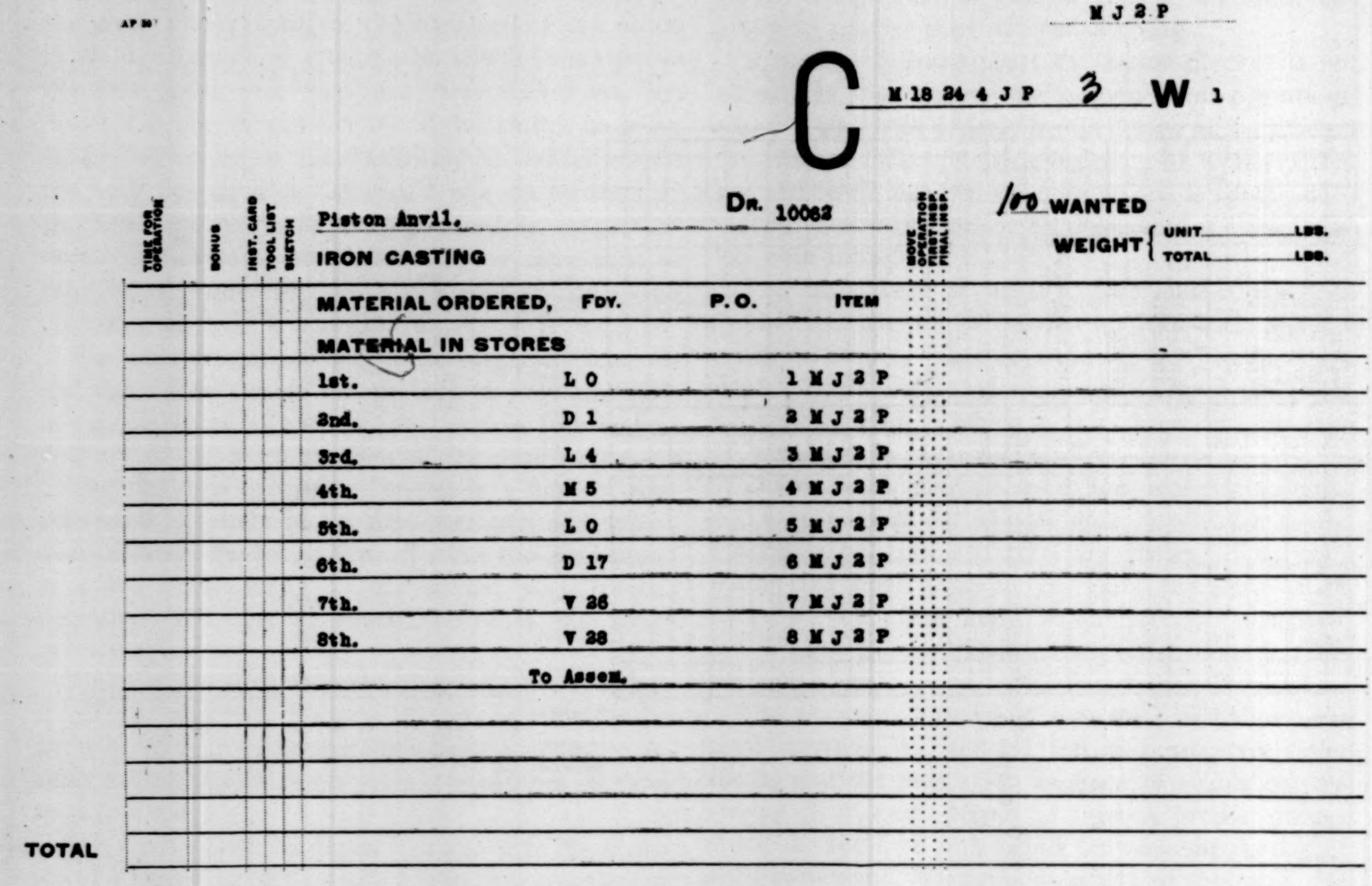
100 WANTED

OPERA-TION	LIST OF PARTS MADE FOR THIS GROUP OR DIVISION	MOVE	W	LIST OF STORES FOR THIS GROUP OR DIVISION	QUAN.	Order'd	In Stores	W AND S	MOVE	Mat. F'y'd
	M J 2 P			SV7/8Z2N	1					
	M J 4 P			SV7/8Z7W	1					
1			1					1		
	M J 1 P			MV1/8x1½ZDS	1					
	M J 18 P									
	M J 19 P									
2			2					2		
	M J 20 P			MV3/16x1¼ZDS	1					
	M J 21 P			MM¼x5/8HNS	2					
	M J 22 P			SV½C6F	2					
				SV5/8P6H						
				SV1B1H	2					
				SV½B4V	1					
				SV½SN	1					
				SV½B16F	1					
4			4					4		
				SM6N	1					
6			6					6		

OPERA-TION	LIST OF PARTS MADE FOR THIS GROUP OR DIVISION	MOVE	W	LIST OF STORES FOR THIS GROUP OR DIVISION	QUAN.	Order'd	In Stores	W AND S	MOVE	Mat. F'y'd
	M J 5 P			MV4B6C	2					
	M J 17 P			SMV3/16x½x1.						
				13/16x7¾WC	1					
				SV3/16x2ZC	1					
				SVM1A						
3			3					3		
				M J V 1½ U	1					
				MV5/8x4Z1H	2					
				MV5/8x3Z1H	1					
				SV5/8Z7W	3					
				SV212APR						
5			5					5		
				SV10-32x3/8Z4M	2					
7			7					7		

TIME FOR OPERATION	BONUS	INS. CARD	TOOL LIST	SKETCH	DRAWING	OPERATIONS IN TH'S COLUMN CAN BE PERFORMED INDEPENDENTLY		MOVE	OPERATION	FIRST INSP.	FINAL INSP.	W ... S	OPERATIONS IN THIS COLUMN MUST BE PERFORMED IN SUCCESSION AS INDICATED BY OPERATION NUMBERS	
					51917 51917	V 5	1 M J P					1		
					51418	D 15	2 M J P					2		
					51917							3	V 5	3 M J P
					53748	V 35	4 M J P					4		
					51917							5	V 5	5 M J P
						V 15	6 M J P					6		
					51917							7	V 5	7 M J P
													V 5	8 M J P
													V 28	9 M J P
													To Stores.	

FIGURE 5



AP 20

M J 2 P

C M 18 24 4 J P 3 W 1

Piston Anvil. Dr. 10062

IRON CASTING

100 WANTED

WEIGHT { UNIT ______ LBS. / TOTAL ______ LBS.

TIME FOR OPERATION	BONUS	INST. CARD	TOOL LIST	SKETCH				MOVE	OPERATION	FIRST INSP.	FINAL INSP.
					MATERIAL ORDERED, FDY.	P.O.	ITEM				
					MATERIAL IN STORES						
					1st.	L 0	1 M J 2 P				
					2nd.	D 1	2 M J 2 P				
					3rd.	L 4	3 M J 2 P				
					4th.	M 5	4 M J 2 P				
					5th.	L 0	5 M J 2 P				
					6th.	D 17	6 M J 2 P				
					7th.	V 26	7 M J 2 P				
					8th.	V 28	8 M J 2 P				
						To Assem.					
TOTAL											

FIGURE 6

hand column must be performed in succession as indicated by their operation numbers. At the top of the sheet are listed the component parts of each operation with spacing provided for checking, as follows:—

The space in the "list of parts made" column is for checking the progress of each component part of the operation, showing it to be finished and delivered to the assembly floor.

The first two spaces in the "list of stores" column, immediately following the quantity, is for the balance of stores clerk to show materials ordered and in stores. The last two columns show the material prepared (or stores issues filled) and moved to the assembly floor.

To provide for the systematic filling of stores issues by the storekeeper or his assistants a standing order is posted in the storeroom bulletin board showing exactly what is wanted and the order in which it is to be filled.

By referring to the route sheet it will be seen that all lines are checked for the first operation, showing everything in readiness to proceed. This sheet is so simple that any boy could, with but little practice, operate it intelligently.

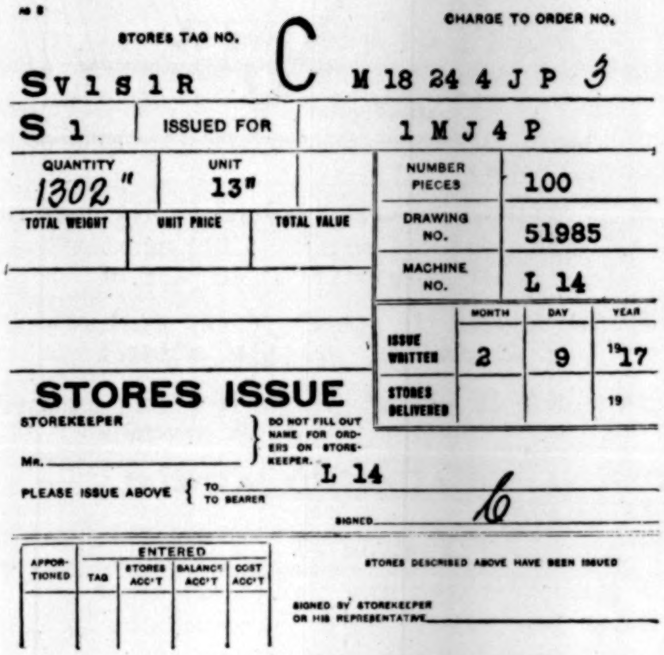
In connection with the assembly route sheet there is also a detail or piece route sheet for each unit made up for the order which is shown in Figure 6.

This sheet is operated very much the same as the assembly sheet, there being but one set of lines for checking. The operations through which the several units pass are listed in logical order, giving the machine or vise numbers, drawings, instruction cards, tool lists etc., for each operation. It is upon the completion of each unit on these sheets that the progress is tranferred to the assembly sheet.

This sheet is used for routing small stock orders consisting of only one piece, or a combination of these sheets can be used on jobs for which there is no route chart.

The issues shown in Figures 7, 8, 9, and 10 are for the various items to be taken from the store-room for use in the first assembly operation, also the bar stock for one of the units used in this operation.

If the product to be analyzed were large enough to be divided into many groups, there would be a route chart and an assembly route sheet for each individual group, all of which would, as heretofore stated, be united in a final or miscellaneous assembly.



STORES TAG NO. C CHARGE TO ORDER NO.

Sv 1 S 1 R M 18 24 4 J P 3

S 1 ISSUED FOR 1 M J 4 P

QUANTITY	UNIT		NUMBER PIECES	100
1302"	13"		DRAWING NO.	51985
TOTAL WEIGHT	UNIT PRICE	TOTAL VALUE	MACHINE NO.	L 14

	MONTH	DAY	YEAR
ISSUE WRITTEN	2	9	19 17
STORES DELIVERED			19

STORES ISSUE

STOREKEEPER

MR. ________ } DO NOT FILL OUT NAME FOR ORDERS ON STOREKEEPER.

PLEASE ISSUE ABOVE { TO / TO BEARER L 14

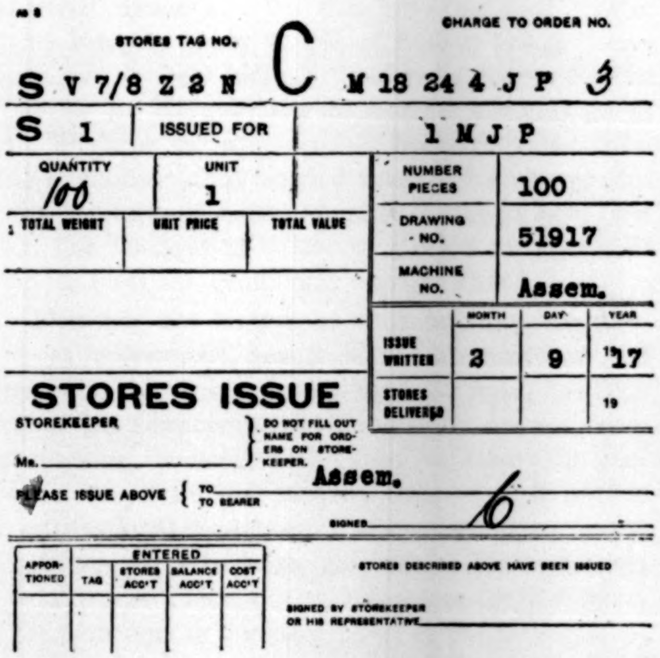
SIGNED 6

APPORTIONED	ENTERED			
	TAG	STORES ACC'T	BALANCE ACC'T	COST ACC'T

STORES DESCRIBED ABOVE HAVE BEEN ISSUED

SIGNED BY STOREKEEPER OR HIS REPRESENTATIVE ________

FIGURE 7



STORES TAG NO. C CHARGE TO ORDER NO.

S v 7/8 Z 2 N M 18 24 4 J P 3

S 1 ISSUED FOR 1 M J P

QUANTITY	UNIT		NUMBER PIECES	100
100	1		DRAWING NO.	51917
TOTAL WEIGHT	UNIT PRICE	TOTAL VALUE	MACHINE NO.	Assem.

	MONTH	DAY	YEAR
ISSUE WRITTEN	2	9	19 17
STORES DELIVERED			19

STORES ISSUE

STOREKEEPER

MR. ________ } DO NOT FILL OUT NAME FOR ORDERS ON STOREKEEPER.

PLEASE ISSUE ABOVE { TO / TO BEARER Assem.

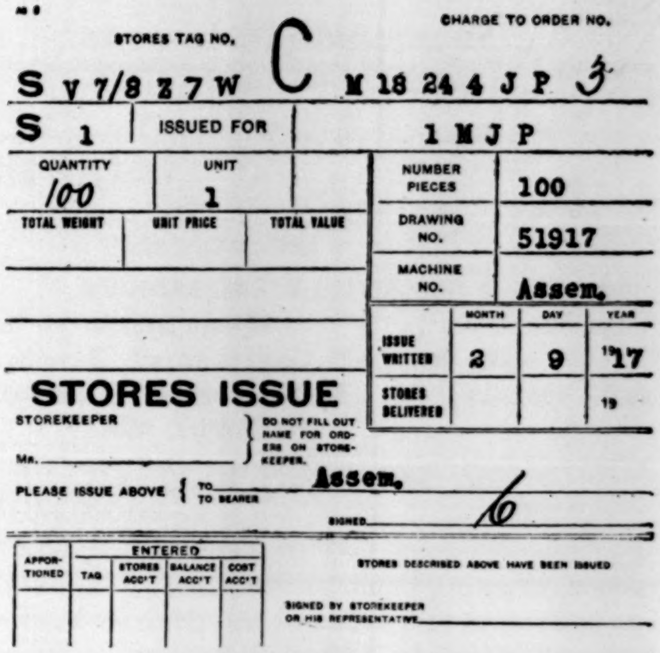
SIGNED 6

APPORTIONED	ENTERED			
	TAG	STORES ACC'T	BALANCE ACC'T	COST ACC'T

STORES DESCRIBED ABOVE HAVE BEEN ISSUED

SIGNED BY STOREKEEPER OR HIS REPRESENTATIVE ________

FIGURE 8



STORES TAG NO. C CHARGE TO ORDER NO.

S v 7/8 Z 7 W M 18 24 4 J P 3

S 1 ISSUED FOR 1 M J P

QUANTITY	UNIT		NUMBER PIECES	100
100	1		DRAWING NO.	51917
TOTAL WEIGHT	UNIT PRICE	TOTAL VALUE	MACHINE NO.	Assem.

	MONTH	DAY	YEAR
ISSUE WRITTEN	2	9	19 17
STORES DELIVERED			19

STORES ISSUE

STOREKEEPER

MR. ________ } DO NOT FILL OUT NAME FOR ORDERS ON STOREKEEPER.

PLEASE ISSUE ABOVE { TO / TO BEARER Assem.

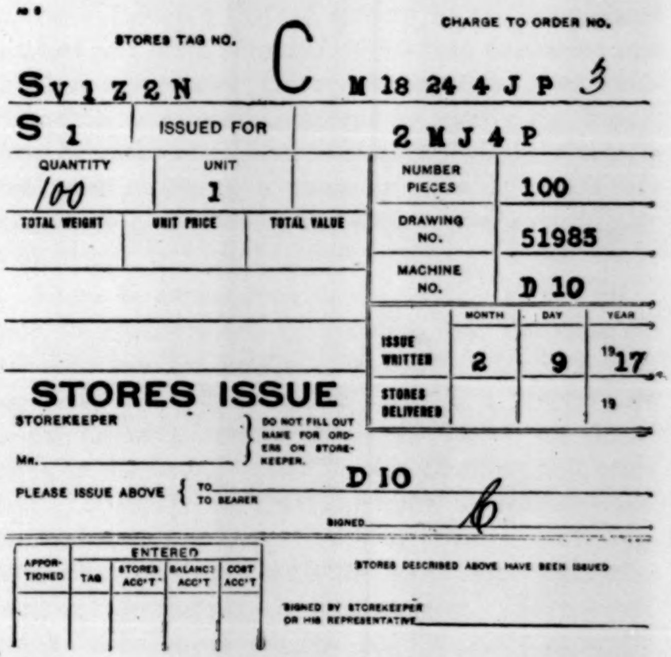
SIGNED 6

APPORTIONED	ENTERED			
	TAG	STORES ACC'T	BALANCE ACC'T	COST ACC'T

STORES DESCRIBED ABOVE HAVE BEEN ISSUED

SIGNED BY STOREKEEPER OR HIS REPRESENTATIVE ________

FIGURE 9



STORES TAG NO. C CHARGE TO ORDER NO.

Sv 1 Z 2 N M 18 24 4 J P 3

S 1 ISSUED FOR 2 M J 4 P

QUANTITY	UNIT		NUMBER PIECES	100
100	1		DRAWING NO.	51985
TOTAL WEIGHT	UNIT PRICE	TOTAL VALUE	MACHINE NO.	D 10

	MONTH	DAY	YEAR
ISSUE WRITTEN	2	9	19 17
STORES DELIVERED			19

STORES ISSUE

STOREKEEPER

MR. ________ } DO NOT FILL OUT NAME FOR ORDERS ON STOREKEEPER.

PLEASE ISSUE ABOVE { TO / TO BEARER D IO

SIGNED 6

APPORTIONED	ENTERED			
	TAG	STORES ACC'T	BALANCE ACC'T	COST ACC'T

STORES DESCRIBED ABOVE HAVE BEEN ISSUED

SIGNED BY STOREKEEPER OR HIS REPRESENTATIVE ________

FIGURE 10